Glismann Road Residential Development, Beaconsfield

Traffic Impact Assessment Report

Client:

Cardinia Shire Council

Project No. 156330a

Final 2 Report – 01/05/2022

1st Floor 132 Upper Heidelberg Road Ivanhoe Vic 3079
PO Box 417 Ivanhoe Vic 3079 Ph: (03) 9490 5900 Fax: (03) 9490 5910
www.trafficworks.com.au

DOCUMENT CONTROL RECORD

Document prepared by:

Trafficworks Pty Ltd

ABN 59 125 488 977

1st Floor 132 Upper Heidelberg Rd Ivanhoe Vic 3079

PO Box 417 Ivanhoe Vic 3079

Ph (03) 9490 5900

Fax (03) 9490 5910

www.trafficworks.com.au

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EXECUTIVE SUMMARY

Trafficworks has been engaged by Cardinia Shire Council to undertake a traffic impact assessment of the proposed residential development at Glismann Road in Beaconsfield.

This residential development comprises all existing lots along the length of Glismann Road, between Old Princes Highway to the south and its truncation at Patrick Place to the north. The site falls within the Beaconsfield Structure Plan.

A Traffic Impact Assessment was carried out to:

- estimate traffic generation and distribution associated with the proposed development
- determine the likely traffic impacts on the existing road network
- determine the suitability of the proposed road network within the Glismann Road area, including the location of side roads, vertical alignment of Glismann Road and sight distance assessments
- provide high-level costs to be included in the Glismann Road Development Contributions Plan (DCP) for the construction of Glismann Road, key local roads and traffic management devices
- identify any necessary mitigating works.

A summary for the site and the proposed development is shown below.

Address	Glismann Road, Beaconsfield
Zoning	Current: Rural Living Zone 1 (RLZ1) Proposed (as part of Amendment C238 of the Cardinia Planning Scheme): Neighbourhood Residential Zone 2 (NRZ2)
Proposed development	Approximately 250 residential lots
Road Network	Old Princes Highway • Currently a four-lane two-way road with a signalised intersection at Glismann Road Glismann Road • Currently a two-way unsealed road providing access to residential properties.
Crash History	Ten (10) reported casualty crashes in the last 5 years at the Glismann Road / Old Princes Highway / Beaconsfield Avenue intersection prior to the signalisation of the intersection.
Traffic Generation	2,250 vehicles per day (vpd) to and from the proposed development 213 vehicles per hour (vph)

Recommendations	It is recommended that: • the design criteria for roads, as set out in the Engineering Design and Construction Manual, are used as a base for the detailed design of the internal road network • the vertical alignment of Glismann Road be altered to ensure Stopping Sight Distance (SSD) is met, involving dropping the existing surface level by 1.6 m at its highest point • a left-out only access be implemented should the potential road connection through properties 111 – 125 Old Princes Highway be proposed to connect with Glismann Road • 'No vehicle access' is to be permitted directly on either side of the crest (no roads, driveways or parking) to accommodate a minimum sight distance requirement of 30 m • 'Restricted vehicle access' is to be permitted along the remaining section of Glismann Road in the vicinity of the crest. This would allow driveway access to be provided onto Glismann Road, subject to an adequate sight distance assessment • on-street car parking be restricted along Glismann Road, to the north of the proposed roundabout • the Glismann Road truncation at Patrick Place be designed as a cul-de-sac type arrangement, with a bowl shaped geometry and a 10.5 m radius • the design speed through the Glismann Road crest be reduced to 40 km/h • traffic calming devices be implemented along Glismann Road on each approach to the crest to ensure speeds of less than 40 km/h will be maintained • on-street car parking be provided along both sides of the carriageway adjacent to the proposed and existing public open space • pedestrian links within the public open space be widened to a 2.5 – 3.0 m width and signed as shared paths for both pedestrians and cyclists • 1.5 m wide footpaths be provided along all local roads • the levy bank be designed to be gradual to allow vehicles to cross over without "bottoming out" or scrapping.

Referenced Documents

References used in the preparation of this report include the following:

- RTA *Guide to Traffic Generating Developments*, Version 2.2, October 2002
- Austroads *Guide to Road Design - Part 3: Geometric Design*
- Austroads *Guide to Road Design - Part 4A: Unsignalised and Signalised Intersections*
- VPA's *Engineering Design and Construction Manual for Subdivision in Growth Areas* (April 2011)
- VPA's PSP Notes, *Our Roads: Connecting People*
- *Public Transport Guidelines for Land Use and Development*, Department of Transport
- AS/NZS 2890.1: *Parking Facilities Part 1: Off-Street car parking.*

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1 INTRODUCTION

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A Traffic Impact Assessment was carried out to:

- estimate traffic generation and distribution associated with the proposed development
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- determine the suitability of the proposed road network within the Glismann Road area, including the location of side roads, vertical alignment of Glismann Road and sight distance assessments
- provide high-level costs to be included in the Glismann Road Development Contributions Plan (DCP) for the construction of Glismann Road, key local roads and traffic management devices
- identify any necessary mitigating works.

2 EXISTING CONDITIONS

2.1 Subject Site

The residential development site (also referred to as the 'Glismann Road Area') includes 21 rural living style lots in Beaconsfield:

- along the length of Glismann Road - 1 to 16 Glismann Road
- 111 to 123 Old Princes Highway.

The majority of land in the residential development site is within the Rural Living Zone 1 (RLZ1) which is inconsistent with the surrounding residential area and State planning policy that is focused on reducing urban sprawl by promoting infill urban development and maximising the use of existing infrastructure, particularly in areas that are close to public transport. The majority of land surrounding the subject site is zoned as General Residential Zone 1 (GRZ1).

The Beaconsfield Structure Plan was adopted by Council in December 2013 and sets out the strategic directions for Beaconsfield for the next 10 – 15 years. An action of the structure plan is to rezone land in the 'Glismann Road area' from the Rural Living Zone 1 (RLZ1) to a residential zone (Neighbourhood Residential Zone 2 – NRZ2) to allow for residential subdivision with a development plan and infrastructure plan. Amendment C238 to the Cardinia Planning Scheme proposes to facilitate and implement this action. It is noted that the Mahon Avenue property has been included in the Cardinia Planning Scheme Amendment C238 for the 'Glismann Road Area' to provide an alternative access point and enable the site to be developed to urban densities.

Vehicular access to the site is proposed to be via the intersection of Glismann Road and Old Princes Highway, with pedestrian and cyclist access also available to the north through to Patrick Place and Timberside Drive.

The location of the site and its surrounding environment are shown in Figure 1. The land use planning zones are shown in Figure 2.

Figure 1: Location Plan (reproduced with permission from Melways Publishing Pty Ltd)

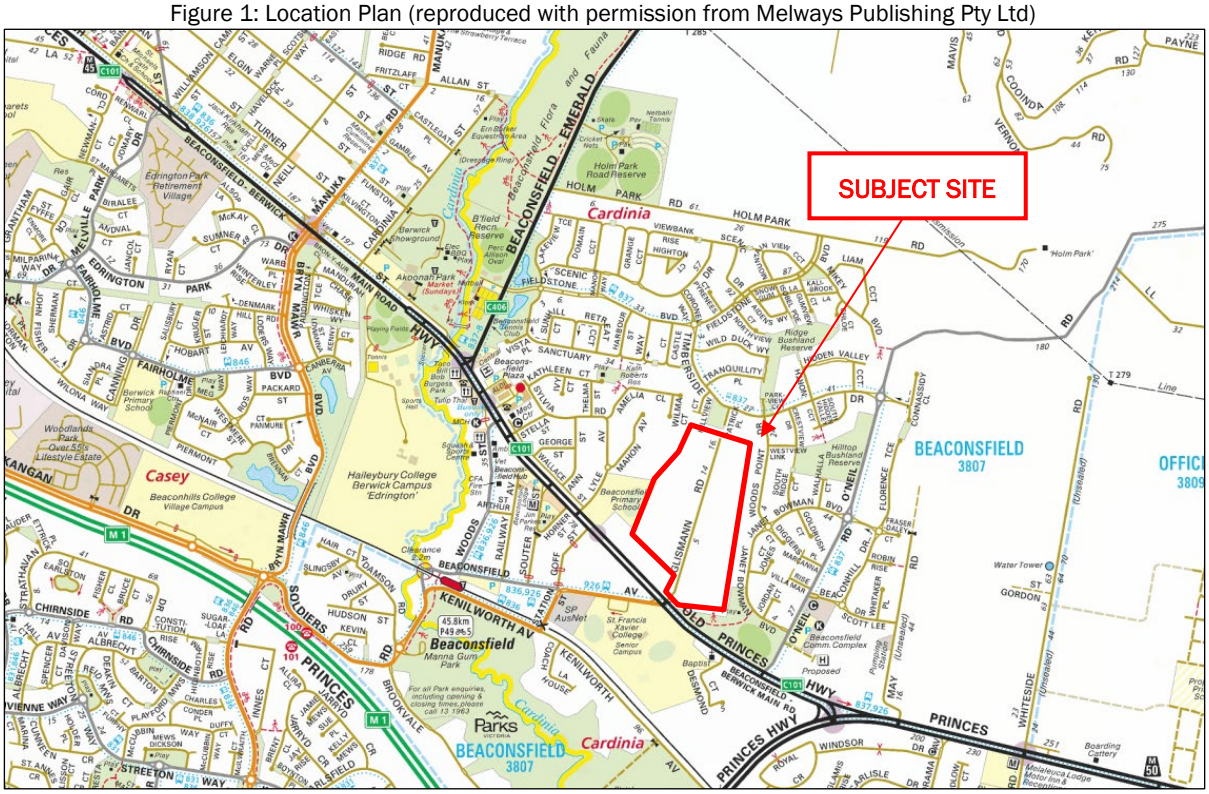
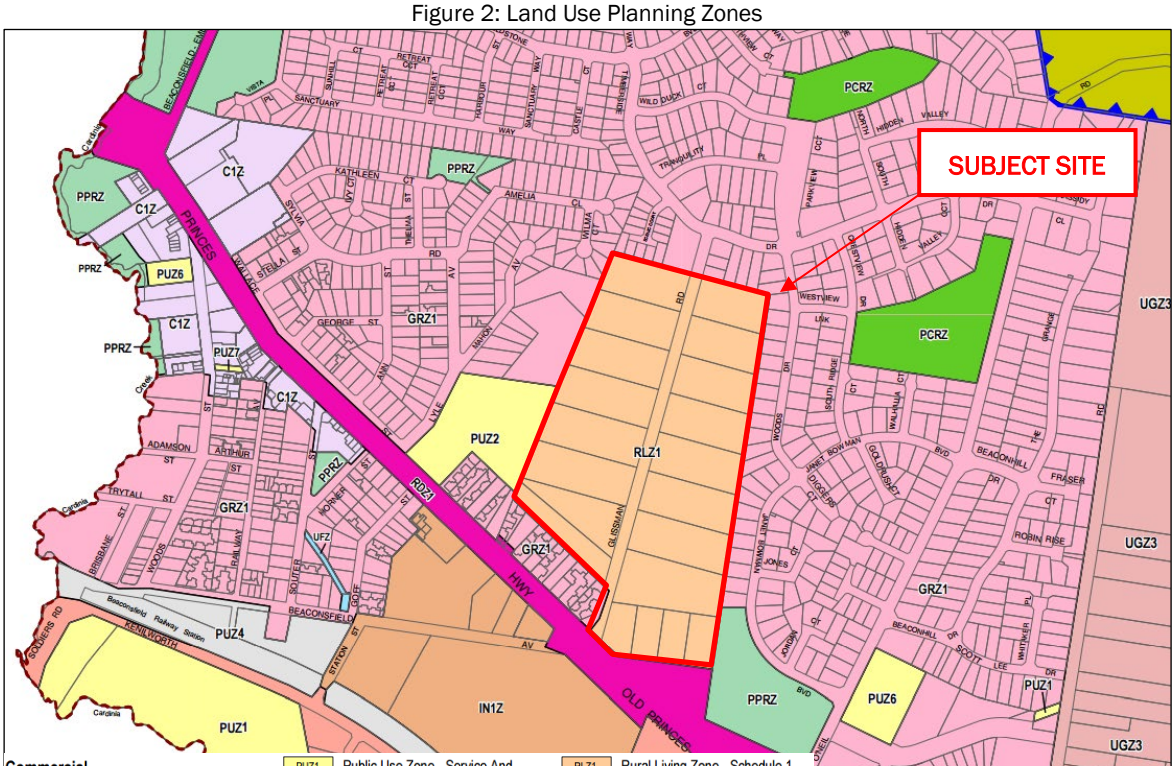


Figure 2: Land Use Planning Zones



2.2 Road Network

2.2.1 Glismann Road

Glismann Road is a local road managed by Cardinia Shire Council which is aligned in a north – south direction. It provides access from Old Princes Highway to the residential properties along its length. Glismann Road is currently an unsealed gravel road with an approximate width of 6.0 m. There is a significant crest located mid-way along Glismann Road. The default urban speed limit of 50 km/h applies along its length.

Glismann Road is currently a cul-de-sac and does not provide a through connection to the north. Ultimately, this configuration is not proposed to be altered to provide a through route for vehicular traffic, however, is likely to accommodate a pedestrian and cyclist connection to Patrick Place and Timberside Drive to the north.

Figure 3: Looking south on Glismann Road towards the intersection of Old Princes Highway

Figure 4: Looking north on Glismann Road towards the existing cul-de-sac

2.2.2 Old Princes Highway

Old Princes Highway is an arterial road managed by the Department of Transport (DoT) and is aligned in a south-east to north-west direction. It provides a connection between the Monash Freeway (M1) in Berwick to the west and Pakenham to the east. Old Princes Highway is a four-lane two-way road with left and right turn lanes at the Glismann Road intersection. A speed limit of 70 km/h applies along Old Princes Highway in the vicinity of Glismann Road.

The Old Princes Highway / Glismann Road intersection is controlled by traffic signals which were constructed in July 2021.

Figure 5: Looking west along Old Princes Highway at the Glismann Road intersection

2.3 Traffic Volumes

The existing traffic volumes were obtained from the DoT Open Data Portal which provides SCATS data for signalised intersections.

The existing traffic volumes for Wednesday 23 February 2022 are shown in Figure 6 to Figure 8 for the following peak periods:

- morning peak hour 8:00 to 9:00 am
- afternoon school peak hour 3:15 to 4:15 pm
- afternoon commuter peak hour 4:30 to 5:30 pm

The traffic volumes in shared movement lanes have been assumed based on the distribution of traffic from surveys undertaken in 2016.

Figure 6: Existing AM peak traffic volumes (8:00 am – 9:00 am)

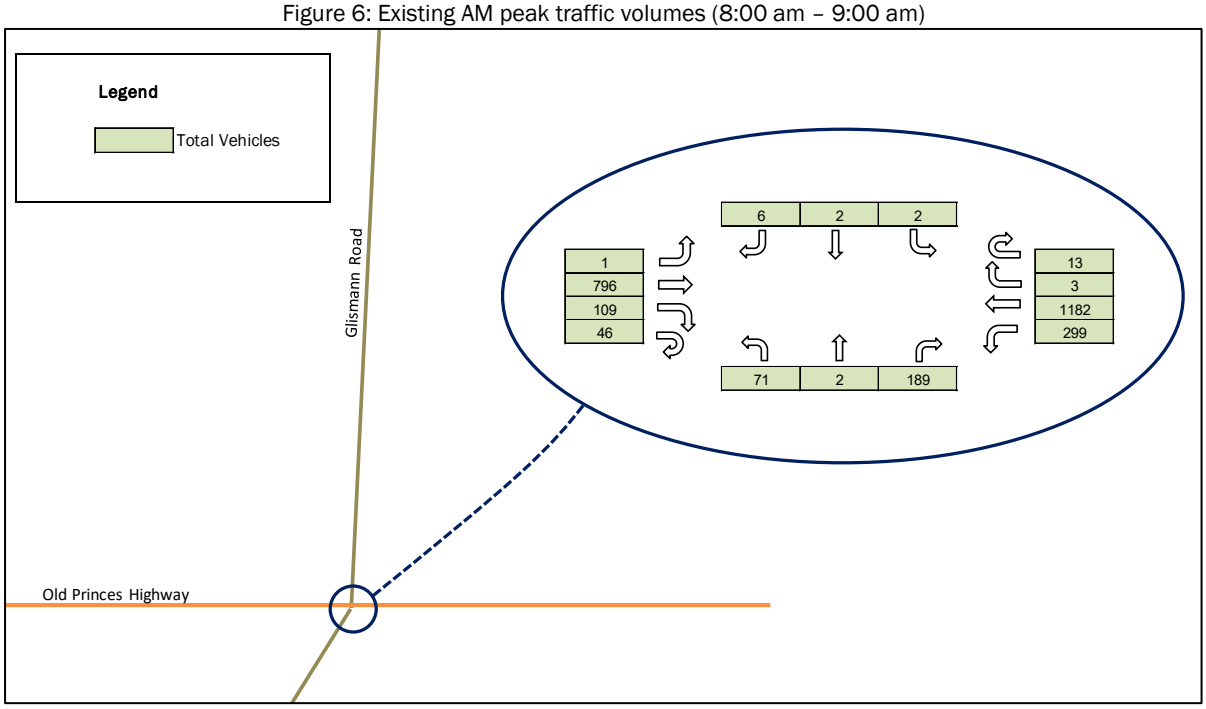


Figure 7: Existing PM school peak traffic volumes (3:15 pm – 4:15 pm)

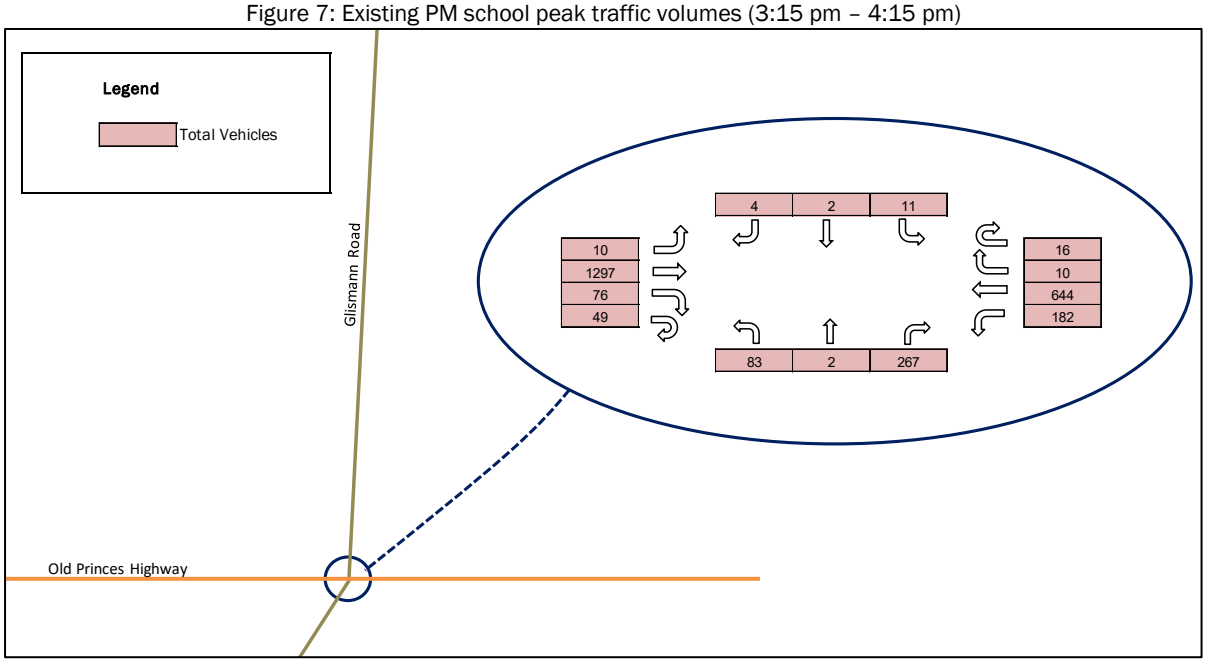
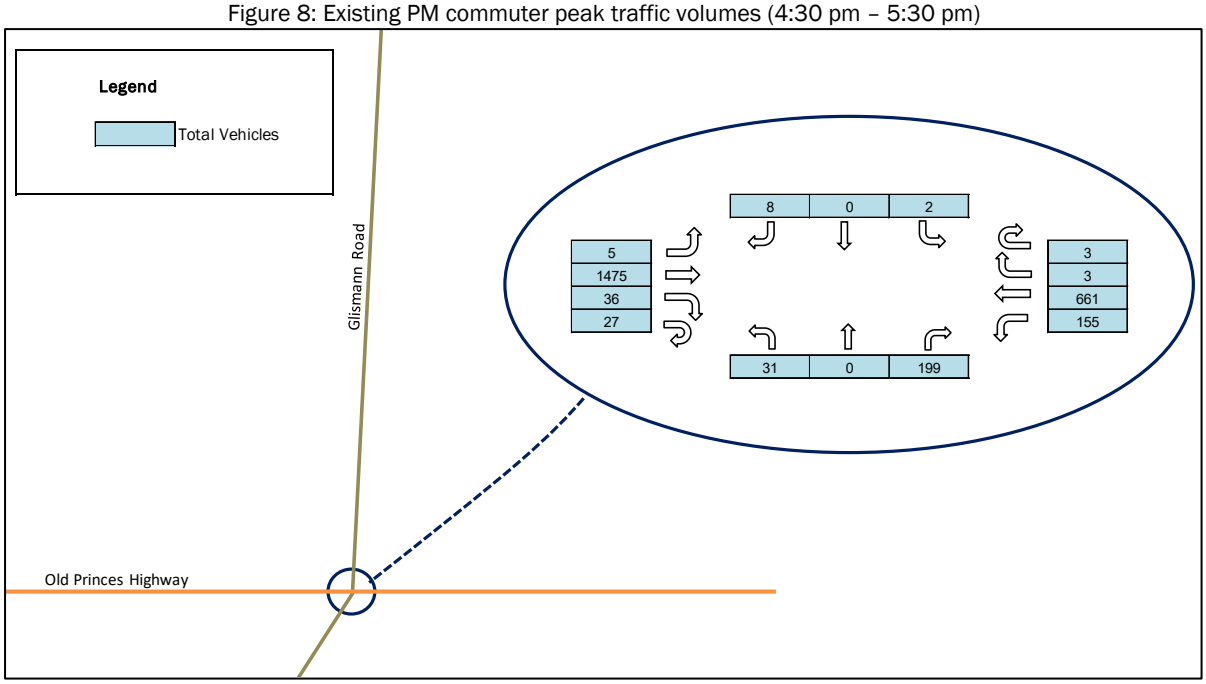


Figure 8: Existing PM commuter peak traffic volumes (4:30 pm – 5:30 pm)



2.4 Crash History

The DoT *Open Data* website indicates that ten casualty crashes have occurred in the last five years of available data (7/01/2015 – 5/10/2021) at the Glismann Road and Old Princes Highway intersection.

- Two "cross traffic" (DCA 110) type crashes. Details of these crashes are as follows:
    - an "other injury" crash occurred on Thursday 4 May 2018 at 6:37 pm, in dark conditions
    - an "other injury" crash occurred on Wednesday 21 January 2016 at 10:00 am, in daylight conditions
- Four "right near" (DCA 113) type crashes. Details of these crashes are as follows:
    - an "other injury" crash occurred at 3:00 pm on Wednesday 25 February 2015, in daylight conditions
    - an "other injury" crash occurred at 4:03 pm on Saturday 30 April 2016, in daylight conditions
    - a "serious injury" crash occurred at 9:49 am on Sunday 24 March 2019, in daylight conditions
    - an "other injury" crash occurred at 6:45 pm on Wednesday 19 February 2020, in daylight conditions
- Two "rear end" (DCA 130) type crashes. Details of these crashes are as follows:
    - an "other injury" crash occurred at 6:20 pm on Monday 3 October 2016, in daylight conditions
    - an "other injury" crash occurred on Tuesday 24 October 2018 at 5.21 pm, in daylight conditions
- An "other injury" crash occurred on Thursday 25 June 2020, in daylight conditions, which was classified as "other opposing manoeuvres not included in DCAs 120 – 125"
- An "other injury" other adjacent at intersection (DCA 119) type crash occurred at 7:45 am on Friday 8 February 2019, in daylight conditions.

The above crash history occurred prior to the signalisation of the intersection. The installation of the traffic signals is anticipated to have resolved the safety issues associated with the sign-controlled intersection.

3 PROPOSED DEVELOPMENT

3.1 Proposed Development Summary

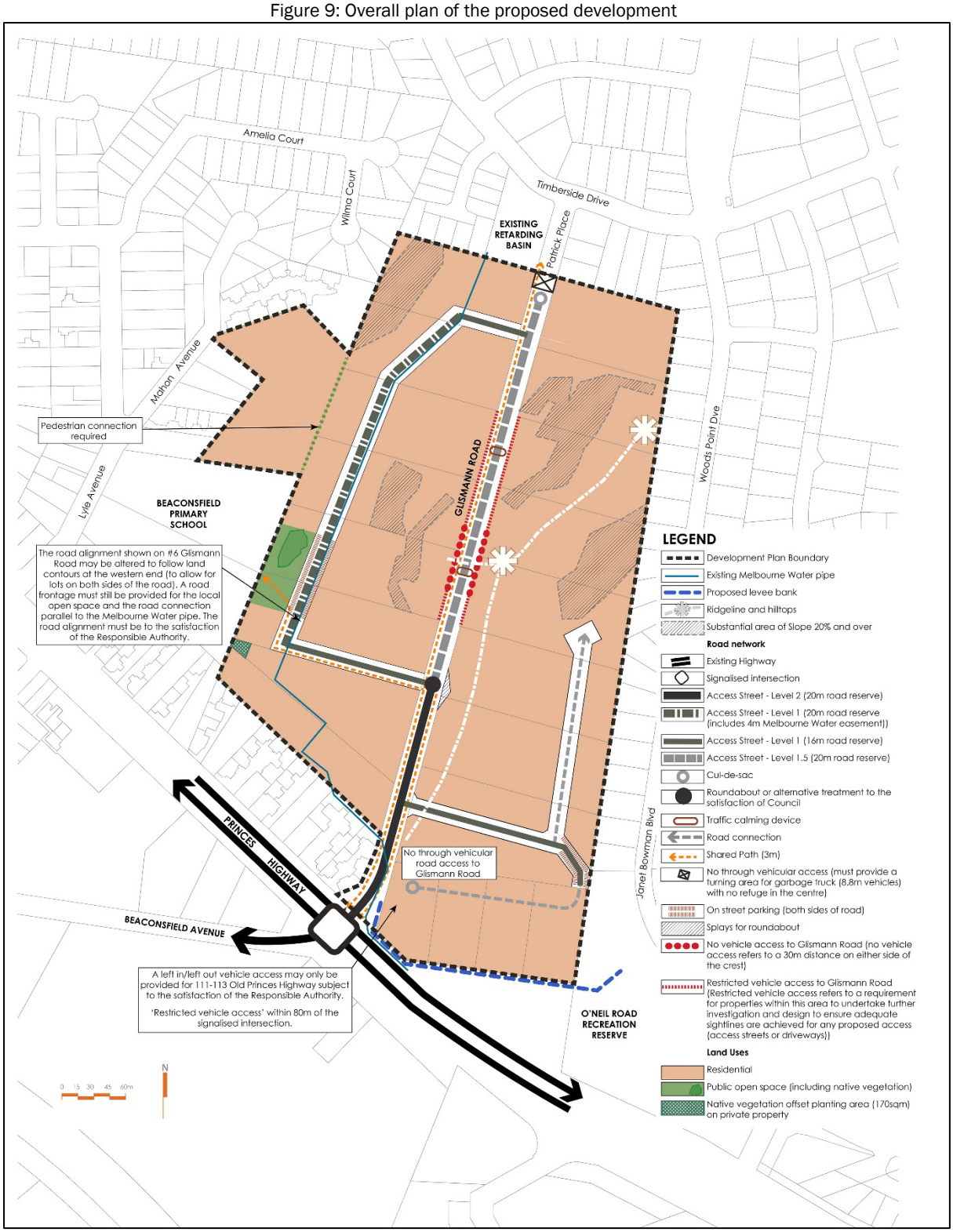
The proposed development consists of the following:

- Land area of approximately 19.7 hectares
- Yielding approximately 250 dwellings, comprising a combination of:
    - Low Density Residential (1,500 m^2 lots)
    - Standard Density Residential, with envelopes (800 m^2 lots)
    - Standard Density Residential (650 m^2 lots)
    - Medium Density Residential (400 m^2 lots)
- Public open space
- An internal trafficable road network comprising Access Streets, Access Places and Access Lanes.

The development is proposed to have vehicular access via the existing signalised intersection at Glismann Road / Old Princes Highway / Beaconsfield Road. No vehicular access will be provided to Timberside Drive / Patrick Place to the north of the development.

Cardinia Planning Scheme Amendment C238 proposes to apply a Development Plan Overlay (DPO) to the Glismann Road Area. The DPO provides the planning framework and contains specific requirements (text and a plan) with regards to the road and pedestrian network, traffic management, open space and residential density for the Glismann Road Area. The plan that forms part of the DPO, prepared by Urban Design and Management, is shown in Figure 9.

Figure 9: Overall plan of the proposed development



3.2 VPA Standard Cross-Sections

The Victorian Planning Authority (VPA), formerly the Metropolitan Planning Authority (MPA), outlines standards for the development of residential subdivisions, as stated within the *Engineering Design and Construction Manual for Subdivision in Growth Areas*. As indicated in the Engineering Design and Construction Manual*:*

The 'Metropolitan Planning Authority (MPA)' formerly the 'Growth Areas Authority (GAA)', in partnership with Councils, land owners developers, service and utility providers, and key stakeholders are responsible for creating new communities in Melbourne's growth areas.

A key objective of the MPA and growth area Councils is to streamline the planning process for creating new communities to increase certainty, reduce costs and reduce regulatory burden to all stakeholders in the land development process through agreed common processes for approvals and shared engineering infrastructure standards and specifications.

The Engineering Design and Construction Manual outlines a series of shared engineering standards and specifications, prepared by the MPA, Cardinia Shire Council and other growth municipalities following consultation with key stakeholders.'

The VPA design criteria for roads are summarised in sections 3.2.1 – 3.2.4. It is recommended that these criteria be used as a base for detailed design of the internal road network.

3.2.1 Access Street (Level 2)

Access Street (Level 2) provides local residential access where traffic is subservient, speed and volume are low and pedestrian movements facilitated. A summary of the design criteria for Access Street (Level 2) is:

- traffic volumes between 2,000 and 3,000 vehicles per day (vpd)
- operating speeds of around 40 km/h
- 6.0 m carriageway width with 2.3 m marked parking on both sides
- minimum verge width of 4.7 m on both sides to accommodate services
- 1.5 m wide paths should be provided on both sides
- optional cycling path / lane
- road reserve width of 20.0 m.

3.2.2 Access Street (Level 1)

Access Street (Level 1) provides local residential access where traffic is subservient, speed and volume are low and pedestrian movements facilitated. A summary of the design criteria for an Access Street 1 (Level 1) is:

- traffic volumes between 1,000 and 2,000 vpd
- operating speeds of around 30 km/h
- 7.3 m carriageway width with unmarked parking on both sides
- verge width of 4.2 – 4.5 m to accommodate services
- 1.5 m wide footpaths should be provided on both sides, with no separate cycling provision
- 16.0 m road reserve.

3.2.3 Access Place

Access Places provide local residential access with shared traffic, however, pedestrians are given priority. A summary of the design criteria for Access Place is:

- traffic volumes between 300 and 1,000 vpd
- operating speeds of around 15 km/h
- 5.5 m carriageway width with unmarked parking[1]
- verge width of 4.2 – 4.5 m to accommodate services
- 1.5 m footpaths should be provided on both sides with no separate cycling provision[2]
- road reserve width of 16.0 m.

3.2.4 Access Lane

Access Lanes provide side or rear access to parking within a lot that has another street frontage. Access Lanes are likely to be the higher density lots near proposed open spaces and interfacing conservation areas. A summary of the design criteria for Access Lanes is:

- the traffic volumes are approximately 300 vpd
- operating speeds of around 10 km/h (can be shared zones with pedestrian, cycling and vehicular access)
- 6.0 m carriageway width with no parking[3]
- road reserve width of 7.0 m.

[1] Carriageway width to be 7.3 m if parking is required on both sides.

[2] Traffic volumes less than 300 vpd, may be reduced to a footpath on one side subject to Council approval.

[3] Turning requirements to access and egress parking on abutting lots may require additional carriageway width. The recommended carriageway width of 5.5 m will provide adequate access to a standard 3.5 m wide single garage built to the property line.

3.3 Proposed Internal Road Network

A north-south Access Street through the development site is proposed and will follow the existing alignment of Glismann Road, between Old Princes Highway and Patrick Place. The proposed Access Street will not provide a vehicular through connection to Patrick Place / Timberside Drive.

The upgraded Glismann Road (access street) is proposed to be located within the existing 20 m wide road reserve and will contain a shared path on one side and a footpath on the other side within the verge areas. The provision of retaining walls at the edge of the road reserve will also be provided, where required. This is to achieve the required carriageway and path crossfalls and verge slopes to match into the existing surface level without requiring land acquisition outside of the existing road reserve.

Due to the steep vertical alignment of Glismann Road and resultant sight line restrictions along the roadway, the access street will have two varying cross sections, with the two sections separated by a roundabout or reverse priority T-intersection.

The southern section of Glismann Road is proposed to be provided in line with the Access Street (Level 2) cross section. The northern section of Glismann Road is proposed to be provided with a modified Access Street cross section, generally in accordance with Access Street (Level 2) but with no provision of on-street car parking lanes (referred to as Access Street Level 1.5). The removal of parking in this location increases the available verge widths and reduces the required height of retaining walls to achieve acceptable grades.

The internal road network will also comprise the following:

- an Access Street (Level 1) along the Melbourne Water pipeline alignment, forming a loop to the west of Glismann Road and providing access to residential lots, the public open space and the rear of Beaconsfield Primary School
- an Access Street (Level 1) to the east of Glismann Road, proposed to be configured as a cul-de-sac and provide access to residential lots and the western end of the O'Neil Road Recreation Reserve
- a series of local access roads (Access Places and Access Lanes) that will connect the residential lots to the three proposed Access Streets.

All roads within the development need to provide sufficient space so that emergency service vehicles, waste collection vehicles and street-cleaning vehicles can carry out their functions while travelling in a forward direction only throughout the development.

3.4 Connection to Surrounding Road Network

The proposed development will have direct access onto Old Princes Highway to the south via the existing signalised intersection.

As there is no through connection proposed, it is assumed that all traffic accessing the development site will be traffic generated from within the development plan area.

4 TRAFFIC GENERATION & DISTRIBUTION

4.1 Traffic Generation

The RTA *Guide to Traffic Generating Developments 2002* used to estimate traffic generation from developments recommends for residential houses:

- a daily rate of 9 trips per dwelling
- a weekday peak hour rate of 0.85 trips per dwelling.

The proposed development is estimated to yield 250 residential dwelling lots. This would result in a total traffic generation of 2,250 vehicles per day (vpd) to and from the development, with morning and afternoon peaks of 213 vehicles per hour (vph).

Table 1 shows the summary traffic generation from the proposed development.

Table 1: Traffic generation from the proposed development

Land Use	Development Unit	Proposed Development	RTA Traffic Generation Rate				Internal Development Traffic Generation	
			Daily		*Peak*			
			Vehicle Trips	*Units*	*Vehicle Trips*	*Units*	*Daily Vehicle Trips*	*Peak Vehicle Trips*
Residential Dwellings	Dwelling	250	9	per dwelling	0.85	per dwelling	2,250	213

4.2 Distribution of Traffic onto the Surrounding Road Network

Peak hour traffic flow for the proposed development would generally be distributed as follows:

- AM peak 80% leaving 20% entering
- PM peak 30% leaving 70% entering

This assumes that all traffic generated will be to and from the proposed development, with no allowance made for the low level of internal trips that may occur.

The directional splits along Old Princes Highway have been determined using existing traffic splits in the peak periods as well as the anticipated destinations of vehicles (i.e. local attractors such as Beaconsfield Township, Beaconsfield train station and local schools and wider attractors such as Berwick, Pakenham and Melbourne via the Princes Freeway).

The traffic volumes anticipated to be generated by the development are shown in Figure 10 to Figure 12.

Figure 10: AM peak development traffic volumes (8:00 am – 9:00 am)

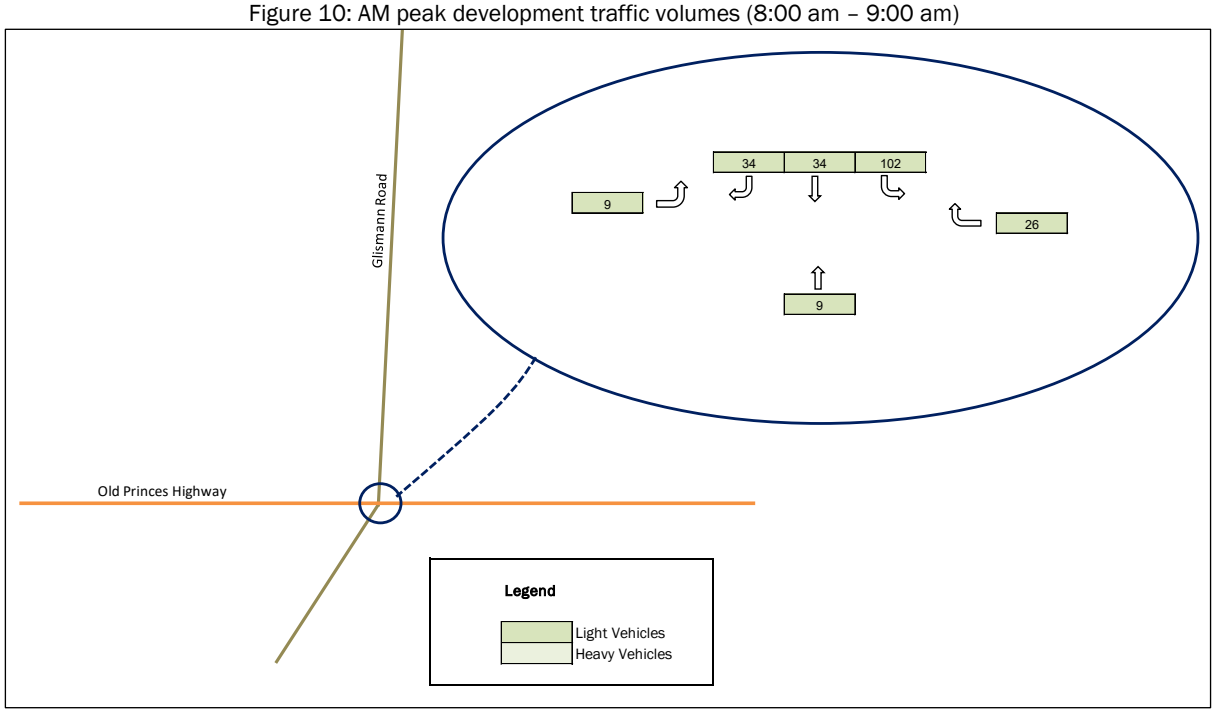


Figure 11: PM school peak development traffic volumes (3:30 pm – 4:30 pm)

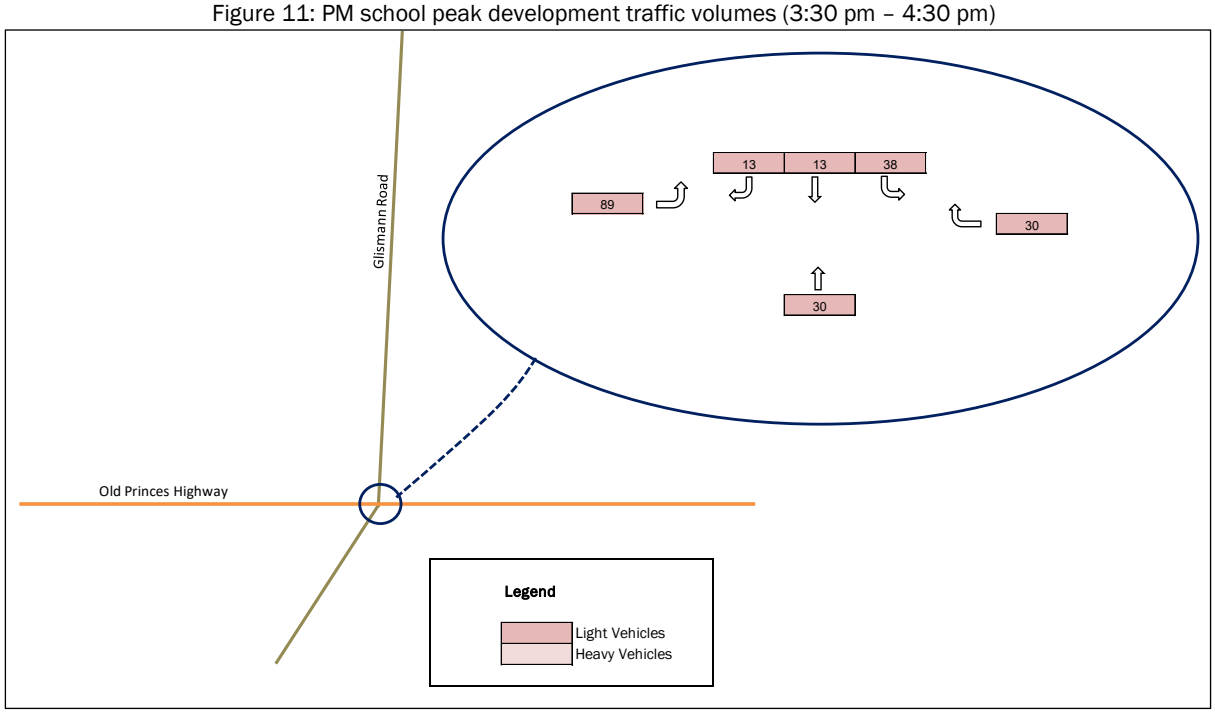
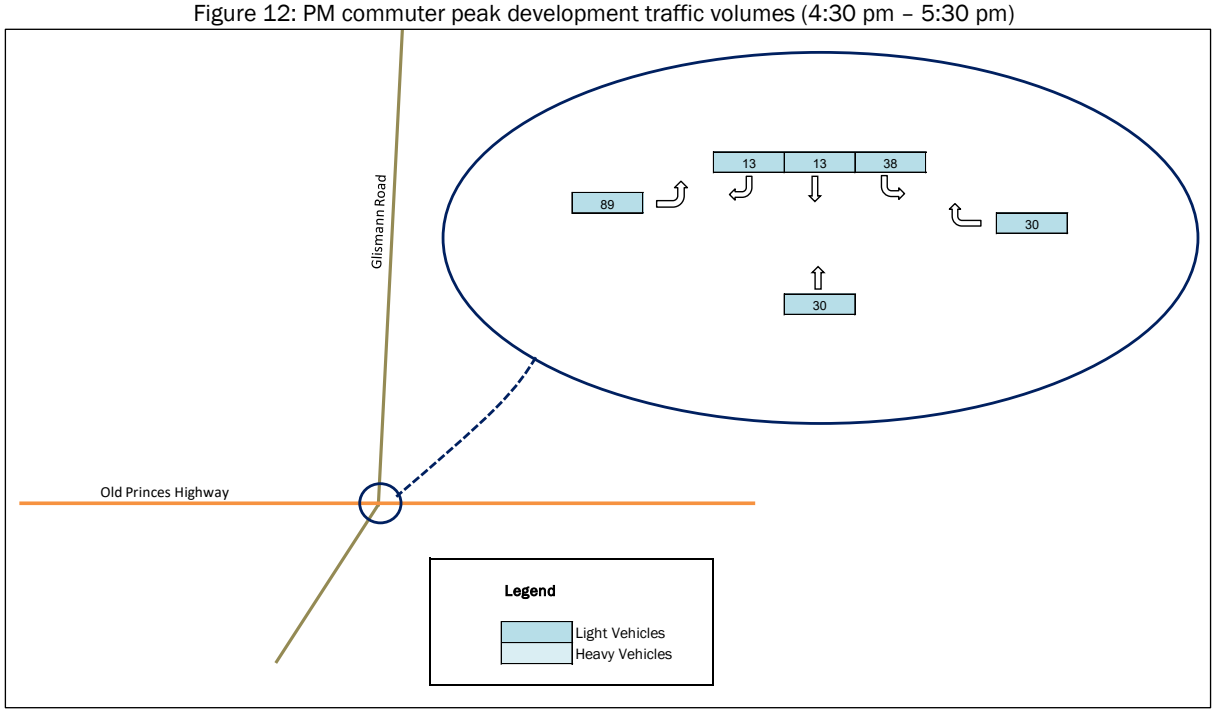


Figure 12: PM commuter peak development traffic volumes (4:30 pm – 5:30 pm)



The peak hour traffic volumes, including the proposed development traffic, are shown in Figure 13 to Figure 15.

Figure 13: AM peak estimated full development traffic volumes (8:00 am – 9:00 am)

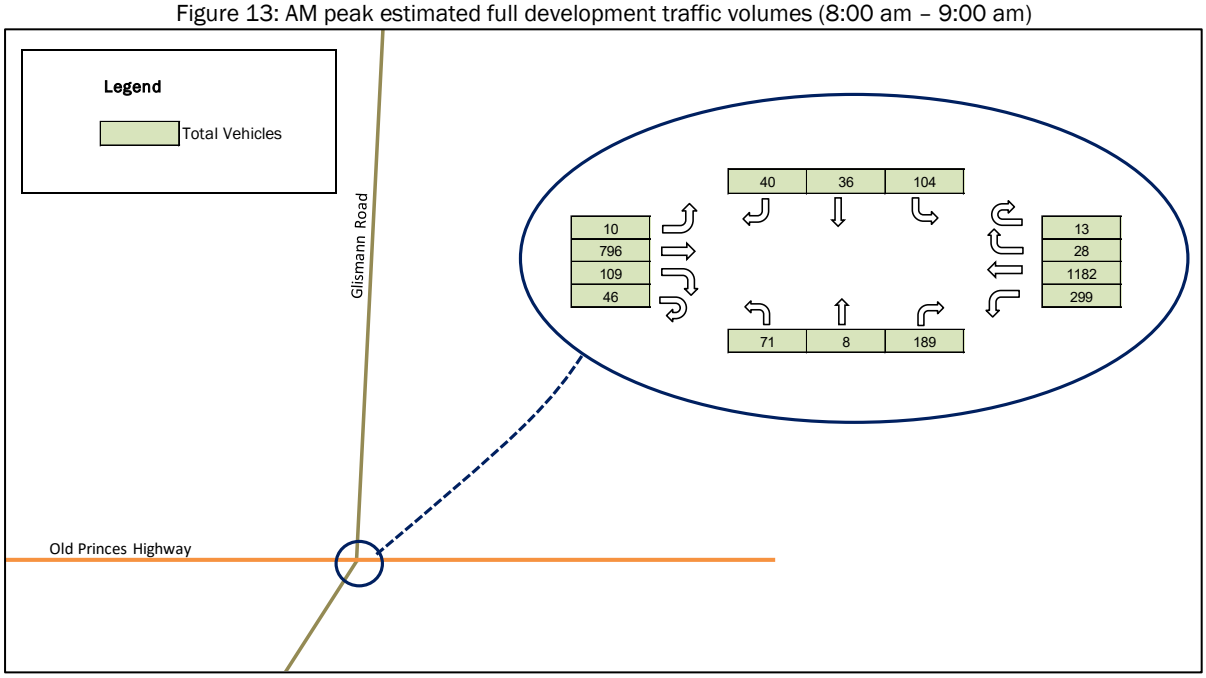


Figure 14: PM school peak estimated full development traffic volumes (3:30 pm – 4:30 pm)

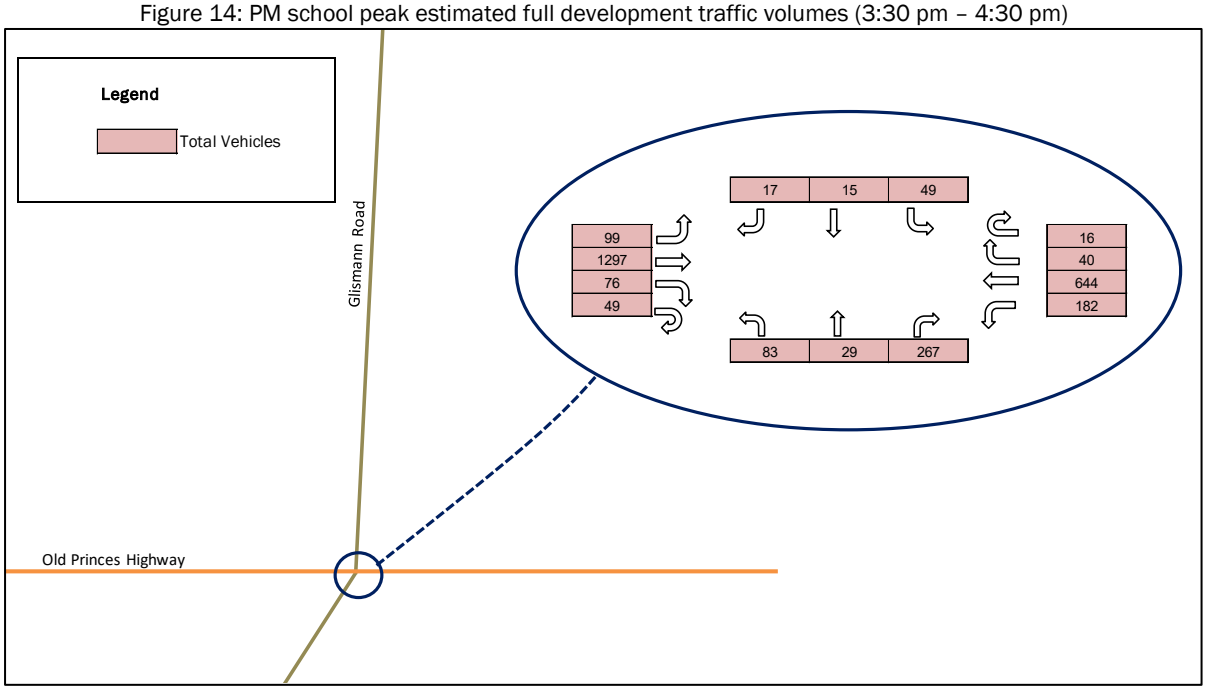
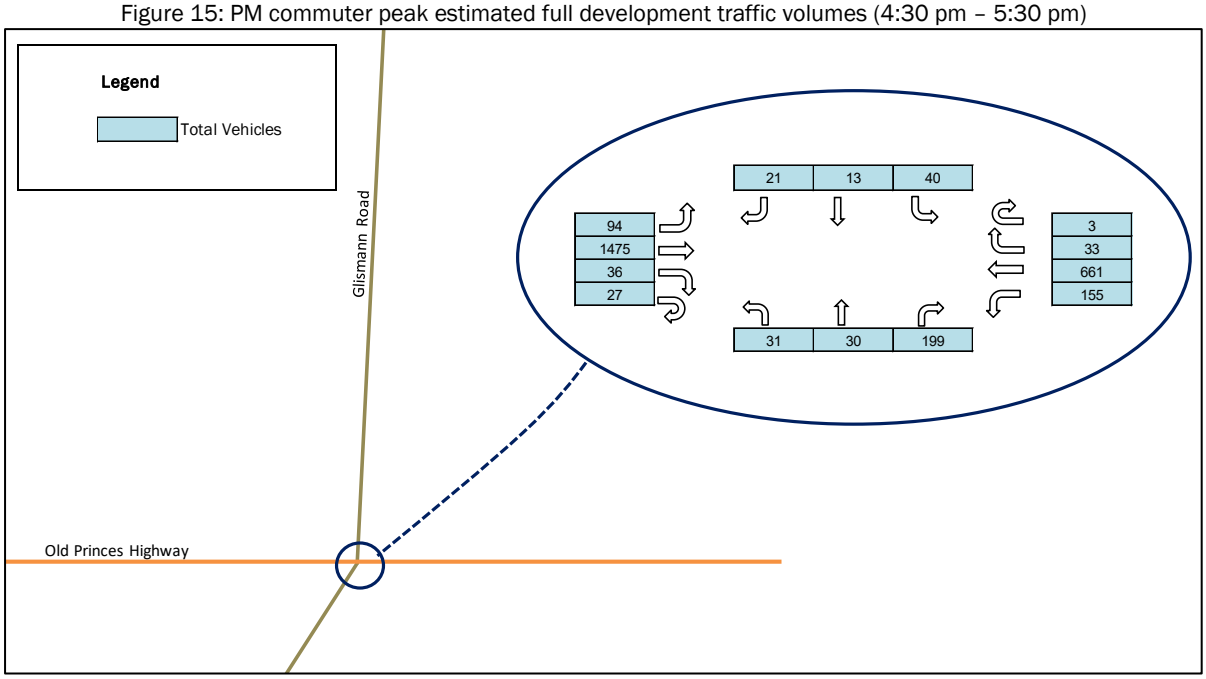


Figure 15: PM commuter peak estimated full development traffic volumes (4:30 pm – 5:30 pm)



4.3 Proposed Internal Road Network Volumes

This section discusses the likely classification of the key internal roads based on the traffic generation and distribution established in sections 4.1 and 4.2.

4.3.1 Glismann Road – Access Street (Level 2)

The traffic volume on Glismann Road, north of Old Princes Highway, is expected to be approximately 2,250 vpd at full development. This is within the design criteria for the Access Street (Level 2) type cross section proposed for Glismann Road.

Based on the design criteria for the Access Street (Level 2), the lot yield of Glismann Road could reasonably be increased to 330 lots (approximately 2,970 vpd). However, the lot yield will be contingent on the signalised intersection being able to accommodate the subsequent increase in peak hour traffic volumes.

Refer to Section 3.2 for cross section specifications.

4.3.2 Access Street (Level 1) / Access Place / Laneway

The development plan indicates that Access Streets (Level 1) are proposed to be located on both the east and west of Glismann Road. The daily traffic volume along each of these roads is not anticipated to exceed 2,000 vpd.

There will be a number of additional local roads (access places or laneways) proposed within the development. The daily traffic volume is anticipated to be up to 1,000 vpd, with volumes of up to 300 vpd along laneways and cul-de-sacs.

5 TRAFFIC IMPACTS & INTERSECTION ANALYSIS

The operation of the Old Princes Highway / Glismann Road / Beaconsfield Avenue intersection has been assessed using SIDRA analysis software for the existing and post development conditions.

The program produces statistics and information on the operation of an intersection but typically the main characteristic used to assess the operation of the intersection is the Degree of Saturation (DOS) which takes into account the 95th percentile queue lengths and delay.

An explanation of the intersection operating characteristics is shown in Table 2.

Table 2: Definitions of intersection operation characteristics

Degree of Saturation (DOS)			Operation
Sign control	Roundabout	Traffic Signals	
< 0.6	< 0.6	< 0.6	Excellent operating conditions, minimal delays
0.6 - 0.699	0.6 - 0.699	0.6 - 0.699	Very good operating conditions, minimal delays
0.7 - 0.799	0.7 - 0.849	0.7 - 0.899	Good operating conditions, delays and queuing increasing
0.8 - 0.899	0.85 - 0.949	0.9 - 0.949	Fair operating conditions, delays and queues growing. Any interruption to flow such as minor incidents causes increasing delays
0.9 – 1.0	0.95 – 1.0	0.95 – 1.0	Poor operating conditions, flows starting to breakdown and queues and delays increase rapidly.
> 1.0	> 1.0	> 1.0	Very poor operating conditions with queues and delays increasing rapidly. Once queues develop it takes a significant time for queues to dissipate resulting in long delays to traffic movements

A Degree of Saturation (DOS) of 0.80 for give-way controlled intersections, 0.85 for roundabouts and 0.90 for signalised intersections is generally used as the maximum acceptable degree of saturation (practical capacity). A DOS of 1.0 implies that theoretical capacity is reached (i.e. the demand is equal to the capacity).

The SIDRA layout is shown in Figure 16. The intersection has been assessed based on a cycle time of 110 seconds.

Figure 16: SIDRA intersection layout – Glismann Road / Old Princes Highway / Beaconsfield Avenue

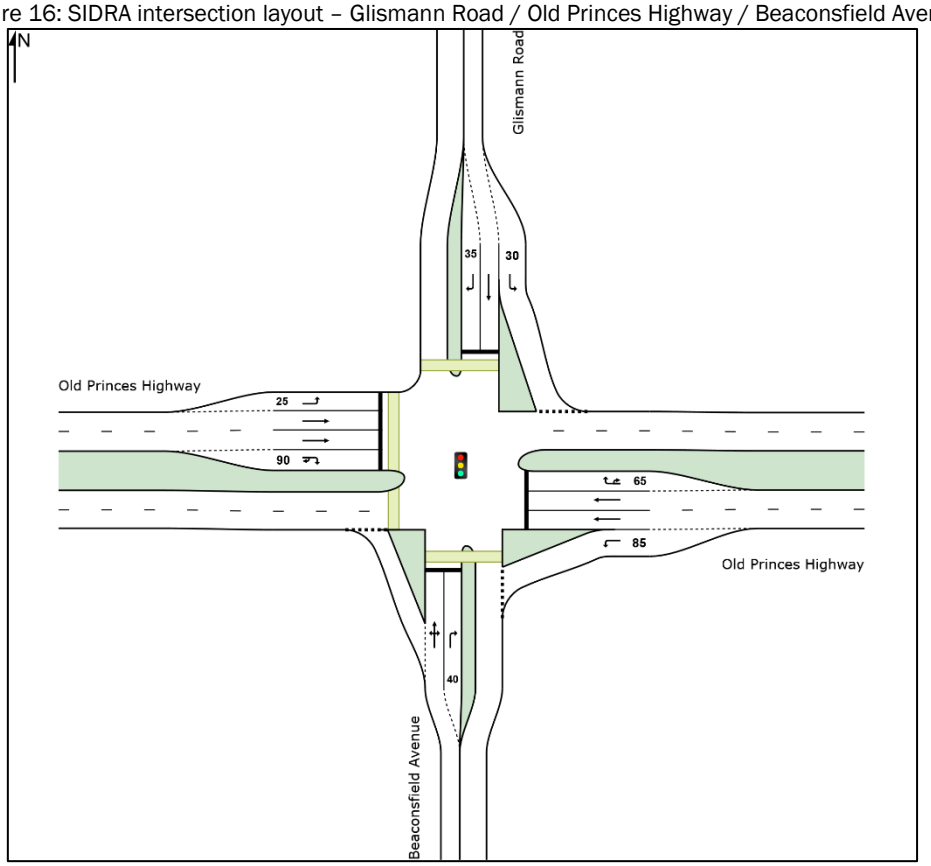


Table 3 provides a summary of the SIDRA analysis results in each of the modelled peak periods, with full SIDRA outputs shown in Attachment A.

The analysis indicates that the intersection will continue to operate under 'good' conditions with the additional traffic generated by the development.

Table 3: SIDRA Results – Existing Intersection Operations (estimated 2020 volumes)

	Movements	Existing									Ultimate								
		DOS			95% Queue (m)			Average Delay (sec)			DOS			95% Queue (m)			Average Delay (sec)		
		AM	School PM	PM	AM	School PM	PM	AM	School PM	PM	AM	School PM	PM	AM	School PM	PM	AM	School PM	PM
Glismann Road / Old Princes Highway	Beaconsfield Avenue (south approach)	0.497	0.677	0.457	48.3	68.8	44.0	45.7	48.5	48.0	0.509	0.734	0.513	49.6	75.7	50.0	46.5	51.2	49.0
	Old Princes Highway (east approach)	0.787	0.453	0.386	226.3	100.1	88.8	24.1	23.1	17.3	0.800	0.633	0.386	227.0	100.1	88.8	25.5	24.7	19.0
	Glismann Road (north approach)	0.063	0.042	0.084	2.4	1.9	3.2	50.1	30.5	52.0	0.420	0.179	0.221	18.4	8.4	8.7	34.5	32.5	37.3
	Old Princes Highway (west approach)	0.757	0.737	0.810	102.2	221.0	268.6	24.0	23.2	25.2	0.757	0.776	0.851	105.1	204.9	289.6	24.5	22.8	28.3

6 SUBDIVISION INTERNAL ROAD LAYOUT

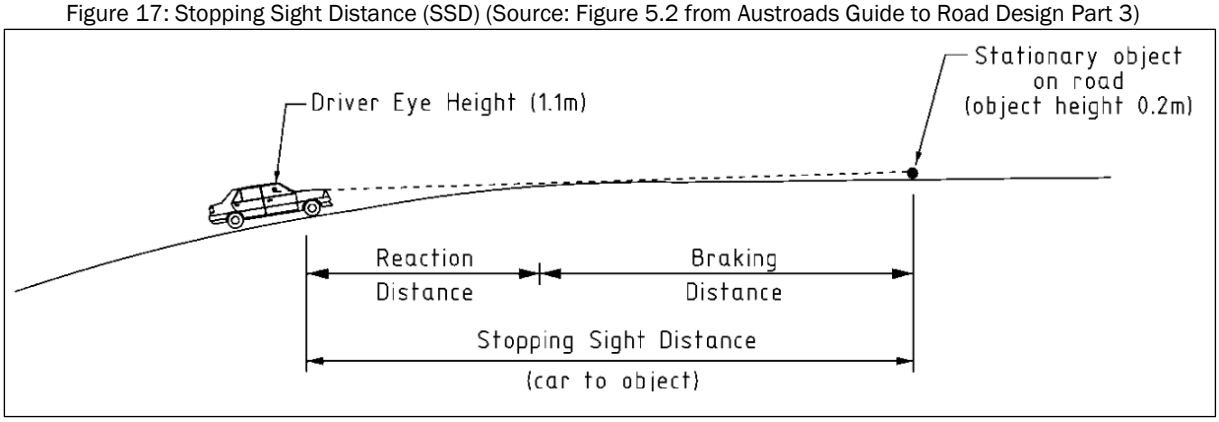
6.1 Glismann Road Vertical Alignment

The vertical alignment of Glismann Road needs to be considered to ensure that adequate sight lines along the roadway are provided, particularly in the vicinity of the crest.

An assessment has therefore been undertaken to ensure that Stopping Sight Distance (SSD) can be achieved along the road alignment.

Stopping Sight Distance (SSD) criteria are outlined in Section 5.3 of the *Austroads Guide to Road Design Part 3: Geometric Design.* This document provides information in relation to the minimum distance which should be provided along roadways to ensure sufficient distance is provided to enable a normally alert driver, travelling at the design speed on wet pavement, to perceive, react and brake to a stop before reaching a hazard on the road ahead (refer Figure 17). The SSD comprises both reaction distance and breaking distance and is measured between driver eye height (1.1 m) and a 0.2 m high object on the road.

Figure 17: Stopping Sight Distance (SSD) (Source: Figure 5.2 from Austroads Guide to Road Design Part 3)



The minimum SSD criterion specified in Table 5.5 of the Austroads Guide requires clear visibility for a desirable minimum distance of 55 m, relating to the general reaction time RT of 2 seconds, a design speed of 50 km/h and a desirable deceleration coefficient of 0.36. Adjustments to correct the SSD based on the average grade of the roadway have also been applied.

In the direct vicinity of the crest, it is considered reasonable that the minimum deceleration coefficient of 0.46 could be applied, due to the constrained conditions and mountainous terrain. This reduces the SSD for a design speed of 50 km/h to 49 m through the crest.

The assessment of SSD along the Glismann Road alignment revealed that a sight distance in excess of 53 m is generally available along its length, however, the existing vertical alignment at the crest will not accommodate the required SSD of 49 m without significant modification.

It is therefore recommended that the design speed through the Glismann Road crest be reduced to 40 km/h, with a reduced equivalent SSD requirement of 36 m. Traffic calming devices should be installed on the approaches to the crest to ensure speeds of less than 40 km/h will be maintained.

Applying the reduced SSD requirement, the assessment indicates that there will still be a deficiency in SSD over the crest for the existing surface levels, however, the extent of the deficiency and the required changes to the existing surface level to achieve the minimum SSD is reduced. Hence, the existing surface level of Glismann Road should be lowered by 1.6 m at its highest point (measured along the centreline) to accommodate SSD requirements.

Refer to Attachment B for the Glismann Road long section, indicating both the existing and proposed surface levels. Refer to Attachment C for the SSD assessment.

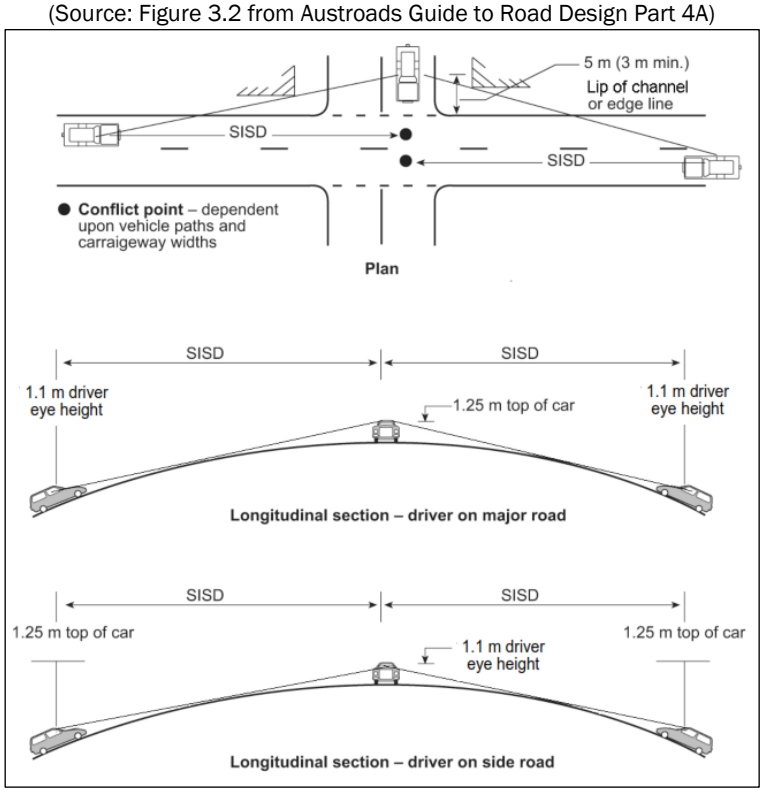
6.2 Location of Local Road Intersections

The location of intersections along Glismann Road (access street level 2) need to be considered to ensure that adequate sight lines along the roadway are provided, particularly on either side of the crest and in close vicinity to the Old Princes Highway intersection.

An assessment has therefore been undertaken to ensure that the proposed intersections are located where adequate Safe Intersection Sight Distance (SISD) can be achieved.

SISD criteria along major roads are outlined in Section 3.2.2 of the *Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections.* This document provides information in relation to the minimum distance which should be provided along major road to allow sufficient distance for a driver on a major road to observe a vehicle approaching from a minor road into a collision situation (e.g. in the worst case, stalling across the traffic lanes) and to decelerate to a stop before reaching the collision point (refer Figure 18).

Figure 18: Safe Intersection Sight Distance (SISD)
(Source: Figure 3.2 from Austroads Guide to Road Design Part 4A)



The minimum SISD criterion specified in Table 3.2 of the Austroads Guide requires clear visibility for a desirable minimum distance of 97 m, relating to the general reaction time RT of 2 seconds and a design speed of 50 km/h. Adjustments to correct the SISD based on the average grade of the roadway have also been applied.

There are three proposed access streets along Glismann Road. The SISD has been assessed at each of the proposed locations and the modified vertical alignment of Glismann Road. Review of the sight distance assessment indicates that SISD requirements will be met at each of the proposed intersections.

Refer to Attachment D for the SISD assessments, including both a plan view and long section.

The development plan indicates that the first side road intersection is proposed to be located approximately 110 m to the north of the Old Princes Highway / Glismann Road / Beaconsfield Avenue intersection. This is considered appropriate as there is adequate sight distance (73 m SSD required) between the side road and the Old Princes Highway intersection, to ensure that a northbound vehicle departing the intersection will be able to observe and react should a stationary vehicle be waiting to turn into the side road.

The Development Plan also indicates that there is a potential road connection through the four properties located at 111 – 125 Old Princes Highway. The northern boundary of these properties is located approximately 70 m north of Old Princes Highway.

Should this potential road connection be proposed to provide an additional connection to Glismann Road, it is considered that any access road would be located too close to the signalised intersection to permit full access, however, a left-out only access would be acceptable.

Hence, should this be implemented, vehicles entering via the proposed access street (first side road) and accessing lots to the south of the access street would be permitted to exit more directly onto Glismann Road via a left-out only access. This intersection would need to be designed to ensure that the other turning movements would be restricted.

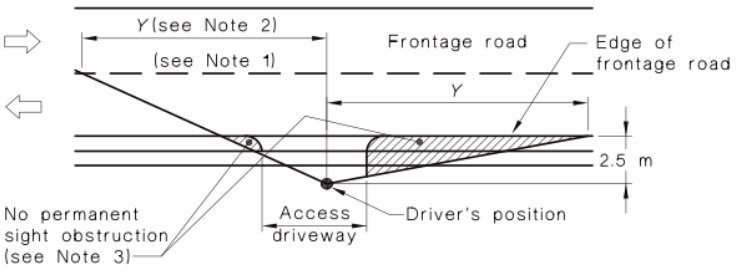
6.3 Location of Property Driveways

The location of property driveways along Glismann Road need to be considered to ensure that adequate sight lines along the roadway are provided, particularly in the vicinity of the crest.

An assessment has therefore been undertaken to ensure that the proposed driveways are located where adequate Entering Sight Distance (ESD) can be achieved. ESD criteria for a driver exiting an access driveway to traffic on the frontage road is outlined in Section 3.2 of *AS/NZS 2890.1 Parking Facilities - Part 1: Off-Street car parking.*

Unsignalised access driveways shall be located so that the intersection sight distance along the frontage road available to drivers leaving the driveway is at least that shown Figure 19.

Figure 19: Sight distance requirements at driveways (Source: Figure 3.2 from AS2890.1)



Frontage road speed (Note 4) km/h	Distance (Y) along frontage road m		
	Access driveways other than domestic (Note 5)		Domestic property access (Note 6)
	Desirable 5 s gap	Minimum SSD	
40	55	35	30
50	69	45	40
60	83	65	55
70	97	85	70
80	111	105	95
90	125	130	Use values from 2nd and 3rd columns
100	139	160	
110	153	190	

The minimum ESD criterion specified in Table 3.2 of the AS/NZS 2890.1 requires clear visibility for a minimum distance of 30 m, for a domestic property access and a design speed of 40 km/h. Hence, it is recommended that:

- 'No vehicle access' is to be permitted directly on either side of the crest (no roads, driveways or parking) to accommodate a minimum sight distance requirement of 30 m (refer to Figure 20).
- 'Restricted vehicle access' is to be permitted along the remaining section of Glismann Road in the vicinity of the crest. This would allow driveway access to be provided onto Glismann Road, subject to an adequate sight distance assessment.

A guide of the design options for the 'restricted vehicle access' section along Glismann Road is detailed in Table 4.

Figure 20: Location of no vehicle access

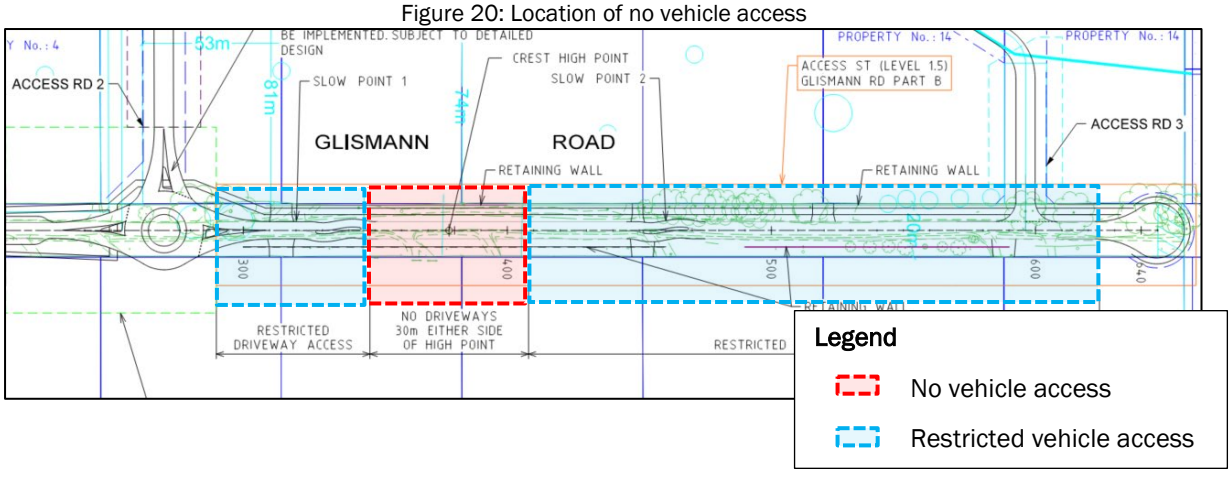


Table 4: Restricted vehicle access options

Access Type	Typical Configuration	Maximum No. Lots	Sight Distance Type	Frontage Road Speed Zone	Minimum Sight Distance Length	Gradient
Driveway Connection	3.0 m wide accessway (min.) (min. 3.5 m wide concrete driveway crossover)	3 lots	AS2809.1 Parking Facilities - Off-Street Car Parking *Sight Distance Requirements at Access Driveways - Domestic Property Access*	40 km/h	30 m	As per AS2809.1, a maximum domestic driveway gradient of 1 in 4 (25%) is desirable. Grade transitions also need to be considered.
				50 km/h	40 m	
	3.0 m - 6.1 m wide accessway (min. 3.5 m wide concrete driveway crossover) *As per Clause 52.06 of Cardinia Planning Scheme, if more than 10 parking spaces and the driveway is more than 50 m long, a 6.1 m wide x 7.0 m long passing area needs to be provided within the property boundary	> 3 lots	Austroads Guide to Road Design, Part 4A - *Minimum Gap Sight Distance (MGSD)*	40 km/h	55 m	
				50 km/h	69 m	

Access Type	Typical Configuration	Maximum No. Lots	Sight Distance Type	Frontage Road Speed Zone	Minimum Sight Distance Length	Gradient
Laneway	6.0 m - 10.0 m wide laneway, with concrete driveway crossover provided	30 lots *(i.e. daily traffic volume of 300 vpd)*	Austroads Guide to Road Design, Part 4A - *Minimum Gap Sight Distance (MGSD)*	40 km/h	55 m	As per Austroads Guide to Road Design Part 3: Geometric Design - General maximum grade of 6-10% 15% "maximum negotiable" grade for heavy vehicles (Council preferred max. grade is 12%)
				50 km/h	69 m	
Local Access Street	5.5 m - 7.3 m wide road carriageway (Access Place)	approx. 30 - 100 lots *(i.e. daily traffic volume of 300 - 1,000 vpd)*	Austroads Guide to Road Design, Part 4A - *Safe Intersection Sight Distance (SISD)*	40 km/h	73 m*	
	7.3 m wide road carriageway (Access Street Level 1)	approx. 100 - 200 lots *(i.e. daily traffic volume of 1,000 - 2,000 vpd)*		50 km/h	97 m*	

**These figures provide a guide on the sight distance length required at types of intersections; however, individual sight distance assessments need to consider the impact of grade on the required distance. For example, a downgrade of 8% in a 40km/h zone increases the SISD requirement by 5 m.*

The above table is provided as a guide only, based on information provided in the following standards and guidelines:

- the Cardinia Shire Council Planning Scheme
- Australian Standard AS2890.1: Parking Facilities Part 1 - Off-Street Car Parking
- Austroads Guide to Road Design Part 3: Geometric Design
- Austroads Guide to Road Desgin Part 4A: Unsignalised and Signalised Intersections.

6.4 On-Street Car Parking

The southern section of Glismann Road is proposed to provide indented 2.3 m wide car parking lanes along its length, south of the proposed roundabout (Access Street Level 2 cross section).

North of the roundabout, the Access Street (Level 1.5) cross section will be implemented, with no on-street car parking to be provided along Glismann Road. This cross section is to be implemented to reduce the carriageway footprint and reduce the height and quantity of required retaining walls.

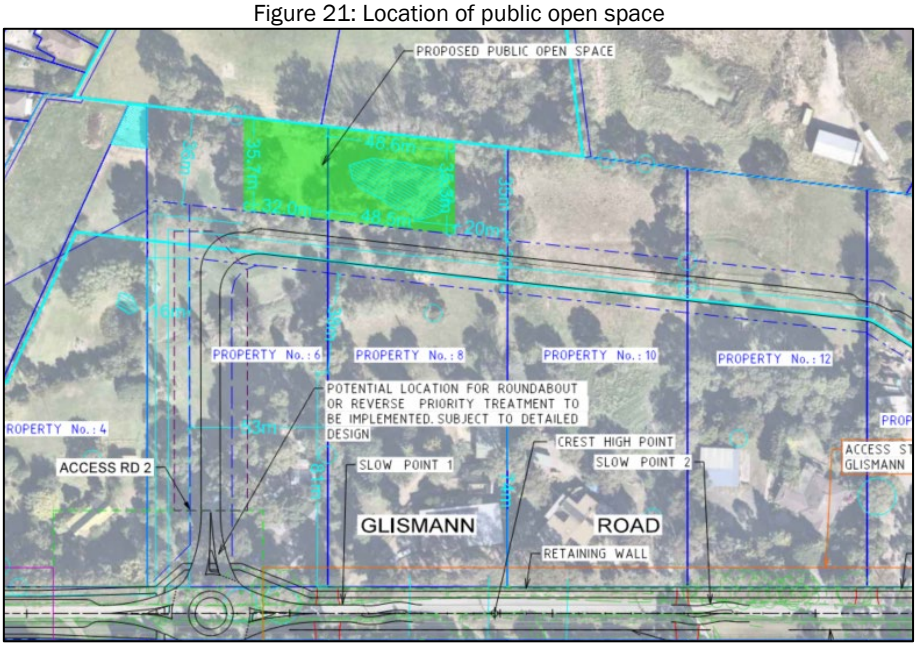
The two additional proposed roads are proposed to have an Access Street (Level 1) cross section, which permits kerbside on-street car parking to occur on both sides of the carriageway. All other internal roads have not yet been identified, however, are likely to permit kerbside car parking on either one or both sides of the carriageway. Car parking should be restricted around bends to ensure the swept paths of vehicles can be accommodated.

It is expected that residential car parking requirements will be met off-street within individual lots and that there will be sufficient on-street car parking to accommodate any visitor car parking demand.

Further to the above, it is recommended that on-street car parking also be provided on both sides of the carriageway adjacent to the proposed areas of public open space.

The proposed 20 m wide road reserve along the western access road adjacent to the public open space will ensure a carriageway of sufficient width can be provided to accommodate unrestricted two-way traffic flows and kerbside car parking on both sides of the road (refer to Figure 21).

Figure 21: Location of public open space



The proposed 16 m wide road reserve along the eastern access road, adjacent to O'Neil Road recreation reserve, will allow kerbside car parking on both sides of the road, however, will require shuttle flow to allow two-way traffic movements. As this road does not provide a through connection, this arrangement is considered sufficient.

6.5 Glismann Road Cross Section

The vertical alignment along Glismann Road is proposed to be dropped by 1.6 m at its highest point to meet SSD requirements (refer to section 6.1).

As per Section 3.3, Glismann Road is proposed to have a unique Access Street (Level 1.5) cross section to the north of the proposed roundabout, with on-street car parking restricted to maximise the available verge width. This has been implemented to minimise the height and extent of retaining walls required to be provided along its length due to the altered vertical alignment, to match the road surface with the natural surface level within the existing road reserve width (20 m).

Typical cross sections along Glismann Road are shown in Attachment E.

An alternative option to avoid the use of retaining walls was considered, however, this option was deemed prohibitive due to the large area of land acquisition required to achieve suitable grades (maximum 4:1 batters) within a widened road reserve width.

It is noted that to provide 4:1 batters, rather than a retaining wall, the surface level will be required to be modified on either side of the existing road reserve, with up to an additional 25 m width required to be acquired as road reserve. As a guide, a high level estimate of the land required to be acquired for road reserve per property is shown in Table 5, with earthworks required within the majority of properties achieve the 4:1 batters.

Table 5: Indicative area of earthworks required to achieve 4:1 batters

Property Address	Area (approx.)
3 Glismann Road	300 m^2
4 Glismann Road	350 m^2
5 Glismann Road	350 m^2
6 Glismann Road	250 m^2
7 Glismann Road	1,250 m^2
9 Glismann Road	1,350 m^2
10 Glismann Road	900 m^2
11 Glismann Road	700 m^2
12 Glismann Road	1,300 m^2
13 Glismann Road	1,800 m^2
14 Glismann Road	1,050 m^2
15 Glismann Road	150 m^2
Total	**9,750 m^2**

6.6 Interim Access onto Old Princes Highway

A levy bank is required along the south border of the development site (along Old Princes Highway). The requirement is for a levy bank of 0.45 m height to be installed in order to accommodate a 1 in 100 year flood.

There are existing shared paths from O'Neil Road Recreation Reserve that run along the southern border of the site, in the location of the required levy bank. Hence, this could be accommodated by creating a levy bank with a flat top and locating the shared path on the levy bank.

There are currently three properties that gain access directly onto Old Princes Highway, via a shared driveway located approximately 170 m east of Glismann Road. Once developed, this shared driveway access point will be closed and access to the lots will be via the internal road network. However, until such time that these lots are developed, temporary access will be required to be maintained from Old Princes Highway to the properties. This will require vehicles to traverse over the top of the levy bank.

Hence, the levy bank will need to be designed with a gradual slope to allow vehicles to cross over without "bottoming out" or scrapping.

6.7 Cul-de-Sacs

The northern end of Glismann Road is proposed to be truncated, and not provide a vehicular connection through to Patrick Place or Timberside Drive. However, a shared path connection will permit pedestrian and cyclist movements between the two residential development areas.

This truncation should be designed as a cul-de-sac type arrangement, to permit passenger and service vehicles to travel in a forward direction at all times. It is recommended that the cu-de-sac is implemented with a bowl shaped geometry and a 10.5 m radius. The design of the road truncation, including the allocated road reserve width, should ensure that there is adequate width available for verges, including a shared path to be accommodated on the west side of Glismann Road to connect into Patrick Place and the existing retarding basin.

Should any other internal roads be truncated to form cul-de-sacs, a similar bowl shaped geometry should be implemented.

6.8 Speed Zoning and Traffic Calming

It is expected that all internal roads within the proposed development will operate under the default urban speed limit of 50 km/h.

The design of Glismann Road (Access Street) should aim to meet target speeds of 40 – 50 km/h and be self-enforceable by avoiding long straight sections of road without traffic calming devices.

Glismann Road is proposed to follow its existing straight alignment, with no horizontal curves along its length. However, there is a vertical crest mid-way along the roadway which is likely to reduce vehicle speeds.

It is recommended that additional traffic calming devices be implemented on each approach to the crest. The specific treatment to be implemented is subject to detailed design due to the limitations on traffic calming devices that can be implemented as a result of the steep gradient along Glismann Road (15.3% to the south of the crest and 6.7% to the north of the crest).

6.9 Public Transport

The *Public Transport – Guidelines for Land Use and Development* indicates that 95% of residential land uses should be designed to allow access to public transport services within 400 - 500 metres

safe walking distance. It also states that as a guideline, bus stops should be located every 300 metres along a bus route.

The subject site has access to the following public transport facilities:

- Bus route 926 - operating between Pakenham Station and Fountain Gate Shopping Centre via Lakeside and Beaconsfield, at approximately hourly intervals. The bus route travels along Beaconsfield Avenue, with bus stops located approximately 110 m south-east of the site's southern access.
- Bus route 837 - operating between Berwick Station and Beaconsfield East via Brisbane Street and Beaconsfield Plaza Shopping Centre, at approximately hourly intervals. The bus route travels along Timberside Drive, with bus stops located approximately 120 m north-west of the site's northern access.
- Bus route 836 - operating between Berwick Station and Eden Rise Shopping Centre via Bridgewater Estate, at approximately hourly intervals. The bus route travels along Station Street and Beaconsfield Avenue, with bus stops at Beaconsfield Railway Station, approximately 700 m south-east of the site's southern access.
- Beaconsfield Railway Station is located approximately 700 m south-east of the site's southern access.

While the majority of lots within the proposed development are likely to be within 400 – 500 m safe walking distance to public transport services (approximately 85% - 90%), some lots developed within the existing properties at #7 – #10 Glismann Road are likely to be between 600 – 700 m from public transport services.

6.10 Pedestrian and Cycle Network

A network of pedestrian and cycling (shared path) linkages are proposed within the development.

Shared paths should be designed to be a minimum of 2.5 m width, with a desirable width of 3.0 m. Footpaths should be designed with a width of 1.5 m.

The updated Glismann Road (comprising both Access Street Level 2 and Access Street Level 1.5 cross sections) is proposed to provide a footpath on one side of the road and a meandering shared path on the other side of the road. Additional pedestrian footpaths are proposed along each of the other local roads within the development site, with linkages provided through public open space to provide access to Beaconsfield Primary School to the west and O'Neil Road Recreation Reserve to the east.

An additional pedestrian and cyclist linkage is also proposed to be provided from the Glismann Road truncation to the north, via Patrick Place and the existing retarding basin, to provide access to the Timberside Drive residential area.

Footpaths should be provided along all local roads, as follows:

- where volumes are below 300 vehicles per day, footpaths could be provided on one side of the road
- where volumes exceed 300 vehicles per day, footpaths are required on both sides of the road to meet the requirements of the VPA's Engineering Design and Construction Manual for Subdivision in Growth Areas.

It is recommended that path linkages through the open space are designed and signed as shared paths (2.5 m – 3.0 m width) to accommodate both pedestrians and cyclists.

This network will support recreational and commuter paths through the development site and will ultimately provide sustainable travel options for residents.

7 CONSTRUCTION COSTS

High-level construction costs associated with key infrastructure within the Glismann Road Development Plan have been estimated based on the concept Glismann Road alignment plans as shown in Table 6. All estimates include a 30% contingency.

Table 6: High-level Construction Cost Estimates

DCP reference	Infrastructure Item	Cost
RD-01	Glismann Road - Access Street (Level 2) *south of the roundabout*	$837,418
RD-02	Glismann Road - Access Street (Level 1.5) *north of the roundabout* *Costs associated with design, siteworks, earthworks and retaining wall components only (including 30% contingency)*	$3,148,574 *$1,213,442*
RD-03	Local Access Street (Level 1) *west of Glismann Road, within #6 Glismann Road*	$494,929
RD-04	Local Access Street (Level 1) *west of Glismann Road, within #16 Glismann Road*	$318,741
RD-05	Local Access Street (Level 1) *east of Glismann Road, within #1 Glismann Road*	$718,911
TM-01	Glismann Road – Roundabout *within road reserve and splays from #3 and #5 Glismann Road*	$681,413

Refer to Attachment F for the high-level cost estimates and site plan indicating road length extents.

It is noted that a reserve priority T-intersection may be appropriate at TM-01 in place of the proposed roundabout. The preferred intersection treatment for TM-01 is subject to detailed design and Council approval.

8 CONCLUSIONS AND RECOMMENDATIONS

The proposed development would not adversely impact on the safety or operation of the surrounding road network, provided the recommended mitigating works are undertaken.

It is concluded that:

- the proposed development is estimated to yield 250 conventional dwellings resulting in a total traffic generation of 2,250 vpd to and from the development, with morning and afternoon (school and commuter) peaks of approximately 213 vph
- the traffic volume along Glismann Road (Access Street Level 2) is expected to be less than 3,000 vpd at full development
- the traffic on access streets (level 1) is expected to be less than 2,000 vpd at full development
- there will be a number of local roads (access places and laneways) proposed within the development. The daily traffic volume along these roads is anticipated to be up to 1,000 vpd, with volumes of up to 300 vpd along laneways and cul-de-sacs
- the Old Princes Highway / Glismann Road / Beaconsfield Avenue intersection will continue to operate under 'good' conditions with the additional traffic generated by the proposed development
- the location of the first side road approximately 110 m north of the Old Princes Highway intersection is considered appropriate.

It is recommended that:

- the design criteria for roads, as set out in the Engineering Design and Construction Manual, are used as a base for the detailed design of the internal road network
- the vertical alignment of Glismann Road be altered to ensure Stopping Sight Distance (SSD) is met, involving dropping the existing surface level by 1.6 m at its highest point
- a left-out only access be implemented should the potential road connection through properties 111 – 125 Old Princes Highway be proposed to connect with Glismann Road
- 'No vehicle access' is to be permitted directly on either side of the crest (no roads, driveways or parking) to accommodate a minimum sight distance requirement of 30 m
- 'Restricted vehicle access' is to be permitted along the remaining section of Glismann Road in the vicinity of the crest. This would allow driveway access to be provided onto Glismann Road, subject to an adequate sight distance assessment
- on-street car parking be restricted along Glismann Road, to the north of the proposed roundabout
- the Glismann Road truncation at Patrick Place be designed as a cul-de-sac type arrangement, with a bowl shaped geometry and a 10.5 m radius
- the design speed through the Glismann Road crest be reduced to 40 km/h
- traffic calming devices be implemented along Glismann Road on each approach to the crest to ensure speeds of less than 40 km/h will be maintained
- on-street car parking be provided along both sides of the carriageway adjacent to the proposed and existing public open space

- pedestrian links within the public open space be widened to a 2.5 – 3.0 m width and signed as shared paths for both pedestrians and cyclists
- 1.5 m wide footpaths be provided along all local roads
- The levy bank be designed to be gradual to allow vehicles to cross over without "bottoming out" or scrapping.

Provided the recommendations outlined in this report are implemented, there are no traffic related reasons that would prevent this development from occurring.

Any alternative solutions recommended in this report would need to ensure good traffic engineering practice is followed and include the consideration of other factors such as:

- topographical constraints for construction
- the avoidance of sign-controlled cross intersections
- the impacts on the ability to provide or design retaining walls and their impacts on sightlines, as well as the protection of view lines.

ATTACHMENT A – SIDRA ANALYSIS RESULTS

ATTACHMENT B – MODIFIED SURFACE LEVEL

ATTACHMENT C – LONG SECTION - SSD

ATTACHMENT D – LONG SECTION - SISD

ATTACHMENT E – TYPICAL CROSS SECTIONS

ATTACHMENT F – COST ESTIMATES

1st Floor 132 Upper Heidelberg Rd Ivanhoe Vic 3079
PO Box 417 Ivanhoe Vic 3079
ABN: 59 125 488 977
Ph: (03) 9490 5900 Fax: (03) 9490 5910
www.trafficworks.com.au

ATTACHMENT A – SIDRA ANALYSIS RESULTS

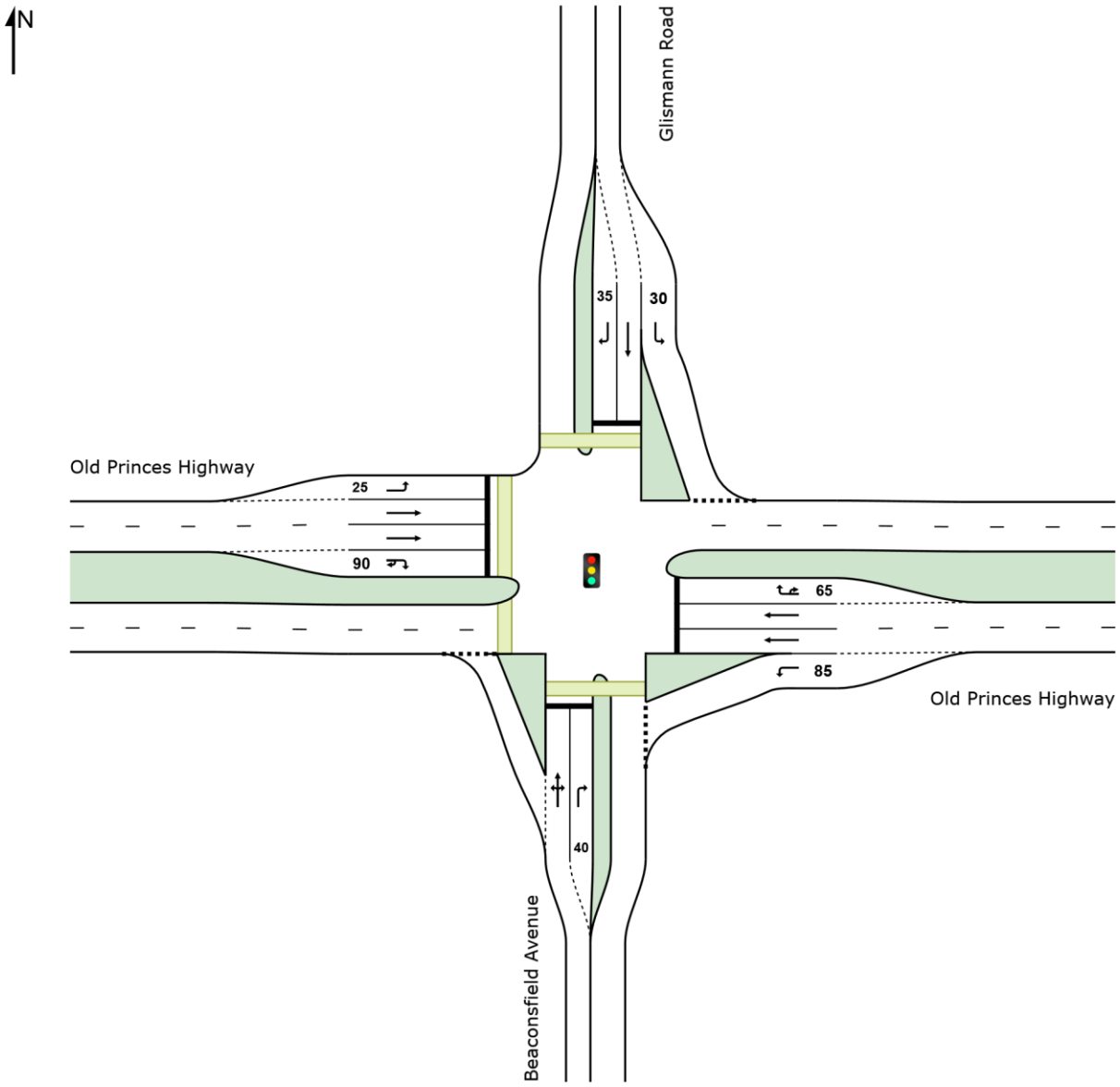
Site: [Old Princes / Beaconsfield / Glismann Int - 8.00 - 9.00 AM Existing (Site Folder: General)]

Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 110 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Green Split Priority has been specified
Phase Sequence: Split Phasing
Reference Phase: Phase E
Input Phase Sequence: A, D, E, F1, F2
Output Phase Sequence: A, D, E, F1, F2

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Beaconsfield Avenue													
Lane 1	147	6.0	296	0.497	100	40.8	LOS D	5.5	40.7	Full	500	0.0	0.0
Lane 2	129	6.0	259	0.497	100	51.2	LOS D	6.6	48.3	Short	40	0.0	NA
Approach	276	6.0		0.497		45.7	LOS D	6.6	48.3				
East: Old Princes Highway													
Lane 1	315	6.0	1576	0.200	100	7.7	LOS A	2.2	16.3	Short	85	0.0	NA
Lane 2	589	9.0	748 [1]	0.787	100	27.4	LOS C	26.0	196.0	Full	500	0.0	0.0
Lane 3	656	9.0	833 [1]	0.787	100	28.0	LOS C	30.0	226.3	Full	500	0.0	0.0
Lane 4	17	0.6	81	0.208	100	64.5	LOS E	0.9	6.6	Short	65	0.0	NA
Approach	1576	8.3		0.787		24.1	LOS C	30.0	226.3				
North: Glismann Road													
Lane 1	2	3.0	720	0.003	100	13.5	LOS B	0.0	0.3	Short	30	0.0	NA
Lane 2	2	3.0	105	0.020	100	56.2	LOS E	0.1	0.8	Full	500	0.0	0.0
Lane 3	6	3.0	100	0.063	100	60.3	LOS E	0.3	2.4	Short	35	0.0	NA
Approach	11	3.0		0.063		50.1	LOS D	0.3	2.4				
West: Old Princes Highway													
Lane 1	1	3.0	1166	0.001	100	13.9	LOS B	0.0	0.1	Short	25	0.0	NA
Lane 2	418	9.0	985 [1]	0.424	100	16.8	LOS B	13.5	101.6	Full	330	0.0	0.0
Lane 3	420	9.0	990	0.424	100	16.8	LOS B	13.6	102.2	Full	330	0.0	0.0
Lane 4	163	4.2	216	0.757	100	61.2	LOS E	9.2	66.4	Short	90	0.0	NA
Approach	1002	8.2		0.757		24.0	LOS C	13.6	102.2				
Intersection	2864	8.0		0.787		26.3	LOS C	30.0	226.3				

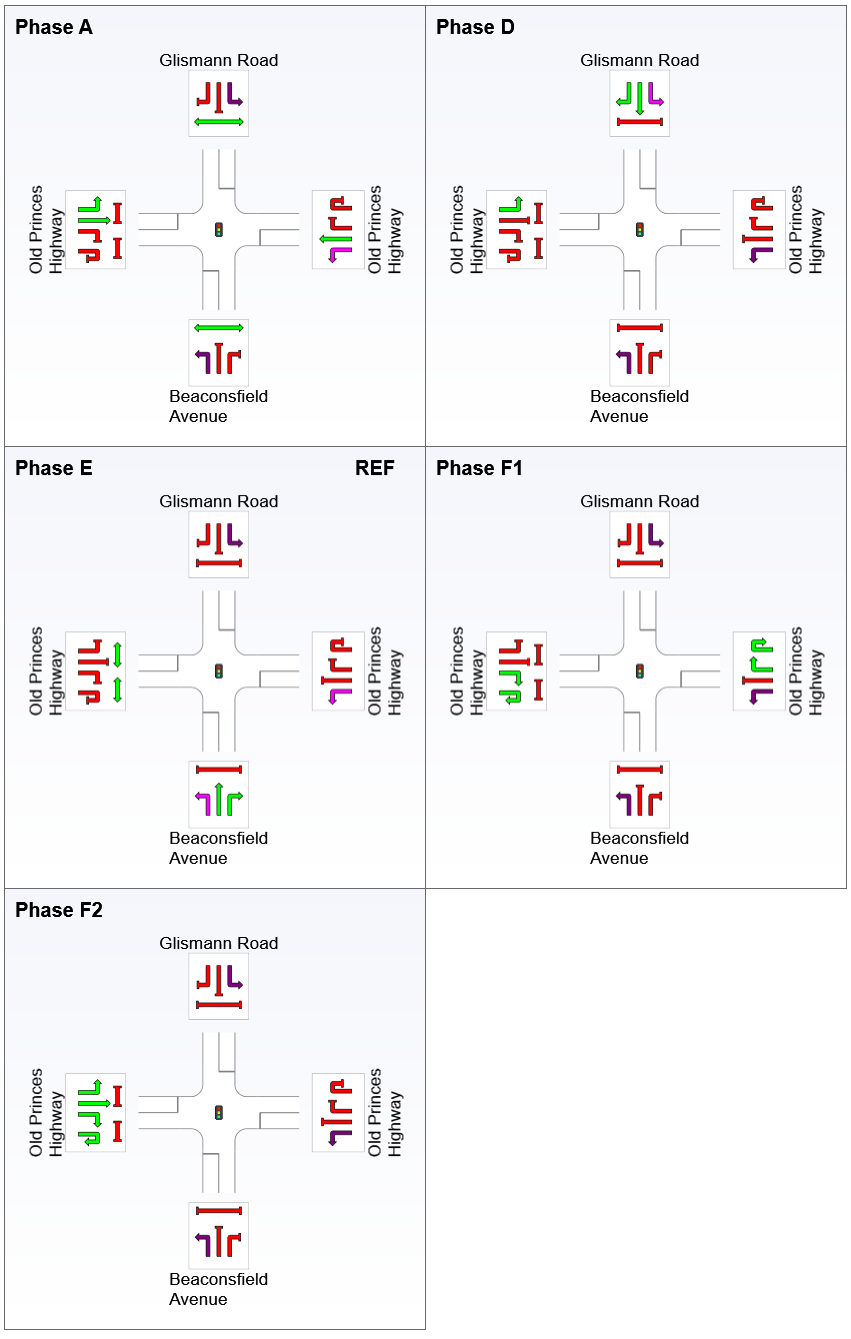
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

[1] Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

Input Phase Sequence

Phase Reference	Sequence: Phase:	Split Phase	Phasing E

Input Phase Sequence: A, D, E, F1, F2



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

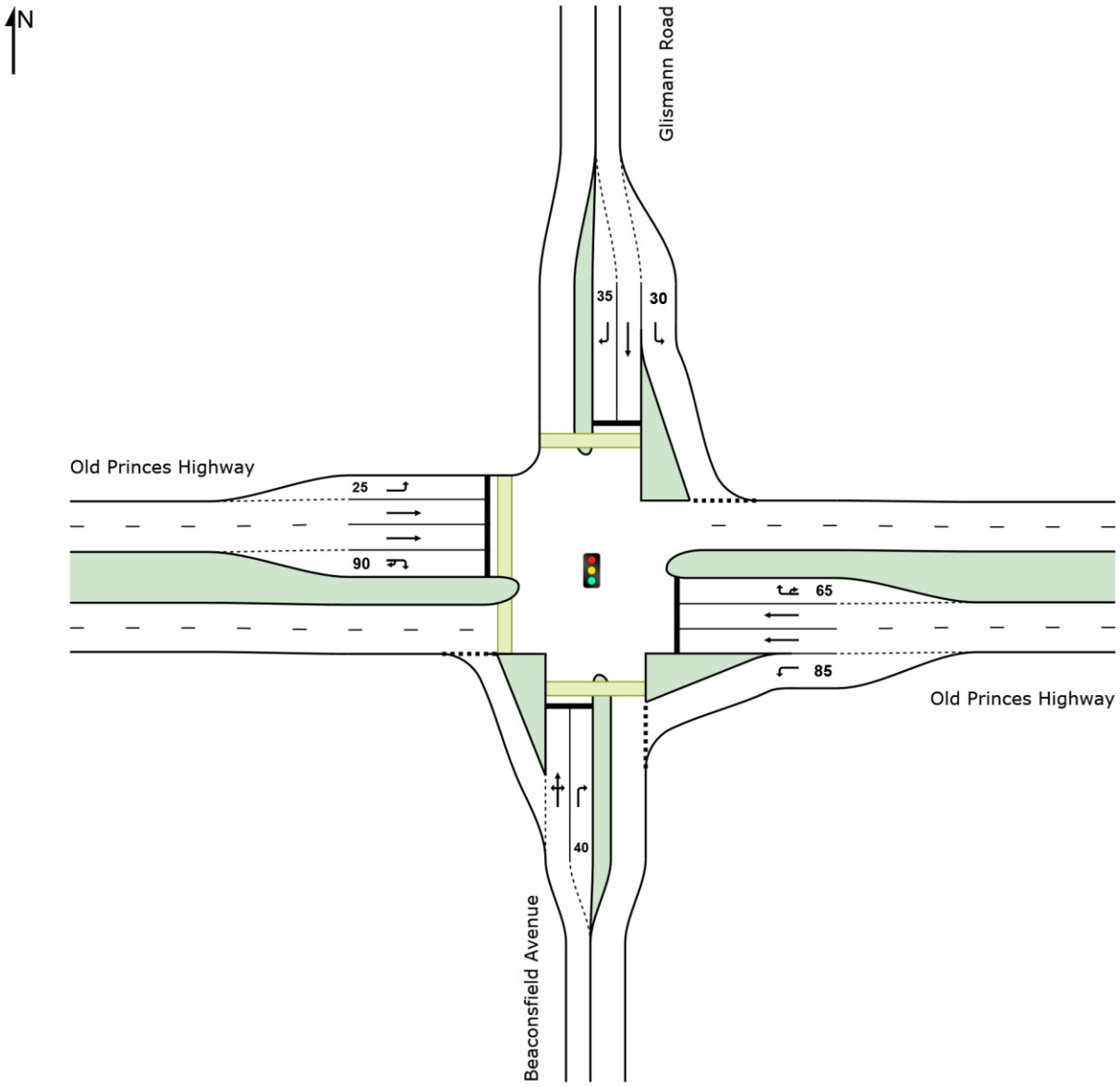
Site: [Old Princes / Beaconsfield / Glismann Int - 3.30 - 4.30 PM Existing (Site Folder: General)]

Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 110 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Green Split Priority has been specified
Phase Sequence: Split Phasing
Reference Phase: Phase E
Input Phase Sequence: A, D, E, F1, F2
Output Phase Sequence: A, D, E, F1, F2

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Beaconsfield Avenue													
Lane 1	195	6.0	288	0.677	100	44.0	LOS D	8.9	65.3	Full	500	0.0	0.0
Lane 2	175	6.0	259	0.677	100	53.5	LOS D	9.3	68.8	Short	40	0.0	NA
Approach	371	6.0		0.677		48.5	LOS D	9.3	68.8				
East: Old Princes Highway													
Lane 1	192	6.0	1579	0.121	100	7.4	LOS A	1.0	7.6	Short	85	0.0	NA
Lane 2	338	9.0	746	0.453	100	25.9	LOS C	13.2	99.8	Full	500	0.0	0.0
Lane 3	339	9.0	749	0.453	100	25.9	LOS C	13.3	100.1	Full	500	0.0	0.0
Lane 4	27	1.2	85	0.321	100	65.0	LOS E	1.5	10.8	Short	65	0.0	NA
Approach	897	8.1		0.453		23.1	LOS C	13.3	100.1				
North: Glismann Road													
Lane 1	12	3.0	592	0.020	100	15.1	LOS B	0.3	1.9	Short	30	0.0	NA
Lane 2	2	3.0	105	0.020	100	56.2	LOS E	0.1	0.8	Full	500	0.0	0.0
Lane 3	4	3.0	100	0.042	100	59.9	LOS E	0.2	1.6	Short	35	0.0	NA
Approach	18	3.0		0.042		30.5	LOS C	0.3	1.9				
West: Old Princes Highway													
Lane 1	11	3.0	1166	0.009	100	14.0	LOS B	0.2	1.4	Short	25	0.0	NA
Lane 2	718	9.0	975 [1]	0.737	100	21.3	LOS C	29.3	221.0	Full	330	0.0	0.0
Lane 3	647	9.0	878 [1]	0.737	100	20.0	LOS B	24.8	186.8	Full	330	0.0	0.0
Lane 4	132	3.6	301	0.438	100	50.7	LOS D	6.4	46.4	Short	90	0.0	NA
Approach	1507	8.5		0.737		23.2	LOS C	29.3	221.0				
Intersection	2793	8.0		0.737		26.6	LOS C	29.3	221.0				

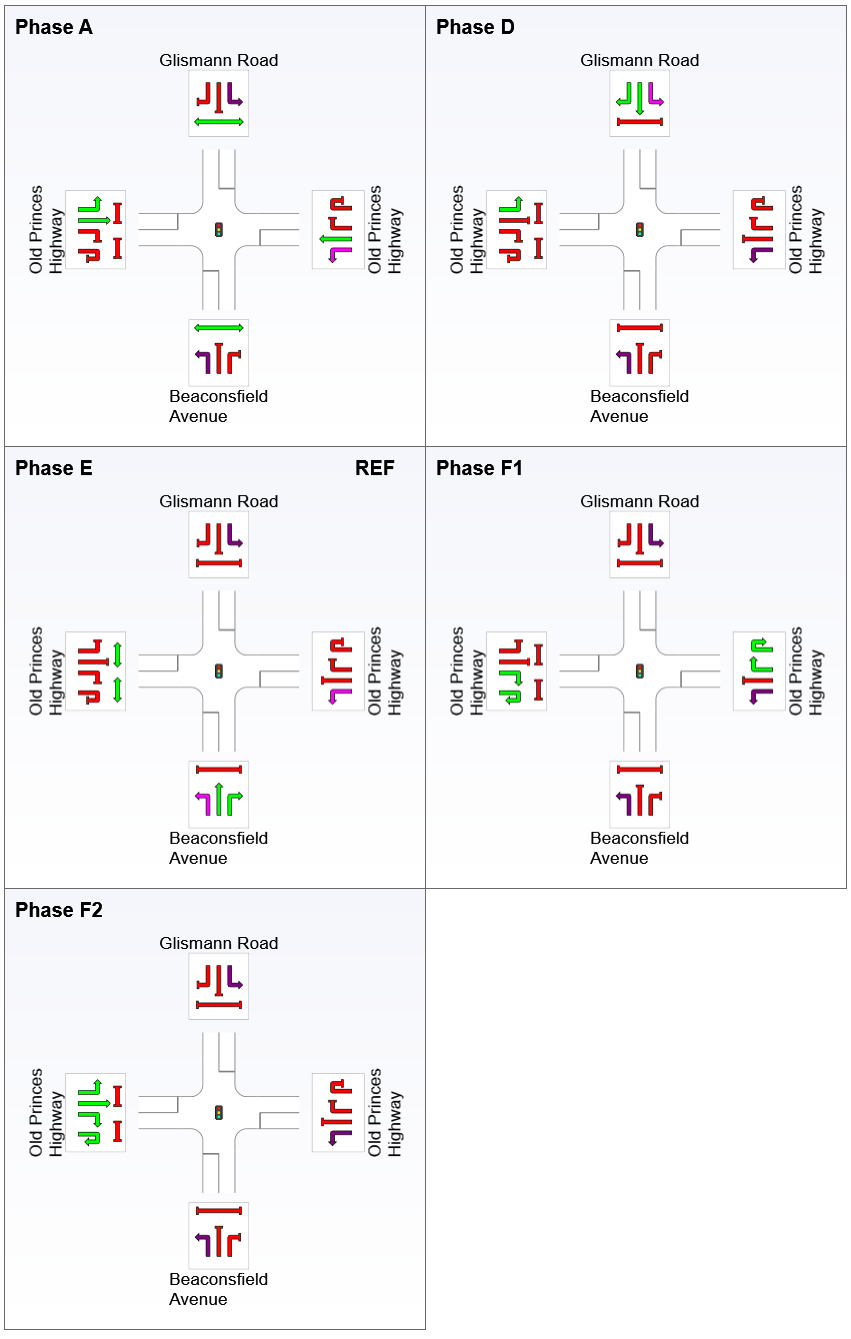
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

[1] Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

Input Phase Sequence

Phase Reference	Sequence: Phase:	Split Phase	Phasing E

Input Phase Sequence: A, D, E, F1, F2



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

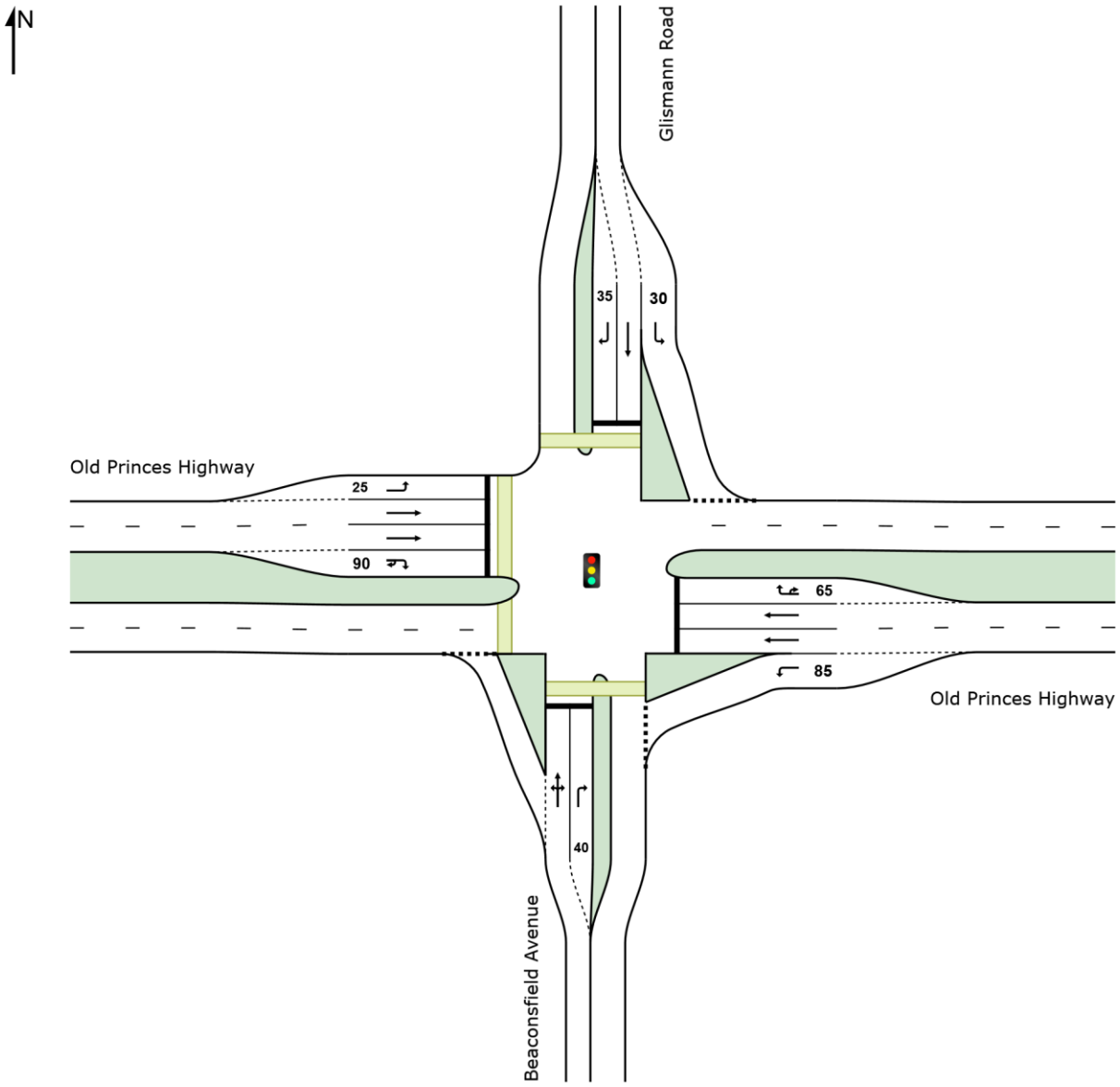
Site: [Old Princes / Beaconsfield / Glismann Int - 4.30 - 5.30 PM Existing (Site Folder: General)]

Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 110 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Green Split Priority has been specified
Phase Sequence: Split Phasing
Reference Phase: Phase E
Input Phase Sequence: A, D, E, F1, F2
Output Phase Sequence: A, D, E, F1, F2

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Beaconsfield Avenue													
Lane 1	125	6.0	273	0.457	100	45.2	LOS D	5.6	41.6	Full	500	0.0	0.0
Lane 2	118	6.0	259	0.457	100	50.9	LOS D	6.0	44.0	Short	40	0.0	NA
Approach	243	6.0		0.457		48.0	LOS D	6.0	44.0				
East: Old Princes Highway													
Lane 1	163	6.0	1655	0.099	100	7.2	LOS A	0.7	5.1	Short	85	0.0	NA
Lane 2	347	9.0	899	0.386	100	19.3	LOS B	11.7	88.5	Full	500	0.0	0.0
Lane 3	348	9.0	902	0.386	100	19.3	LOS B	11.8	88.8	Full	500	0.0	0.0
Lane 4	6	1.5	88	0.072	100	63.0	LOS E	0.3	2.4	Short	65	0.0	NA
Approach	865	8.4		0.386		17.3	LOS B	11.8	88.8				
North: Glismann Road													
Lane 1	2	3.0	617	0.003	100	16.2	LOS B	0.0	0.4	Short	30	0.0	NA
Lane 2	1	3.0	105	0.010	100	55.8	LOS E	0.1	0.4	Full	500	0.0	0.0
Lane 3	8	3.0	100	0.084	100	60.5	LOS E	0.5	3.2	Short	35	0.0	NA
Approach	12	3.0		0.084		52.0	LOS D	0.5	3.2				
West: Old Princes Highway													
Lane 1	5	3.0	1166	0.005	100	14.0	LOS B	0.1	0.7	Short	25	0.0	NA
Lane 2	795	9.0	981 [1]	0.810	100	24.0	LOS C	35.6	268.6	Full	330	0.0	0.0
Lane 3	758	9.0	935 [1]	0.810	100	23.6	LOS C	33.1	249.5	Full	330	0.0	0.0
Lane 4	66	3.4	164	0.405	100	59.1	LOS E	3.5	25.2	Short	90	0.0	NA
Approach	1624	8.8		0.810		25.2	LOS C	35.6	268.6				
Intersection	2744	8.4		0.810		24.9	LOS C	35.6	268.6				

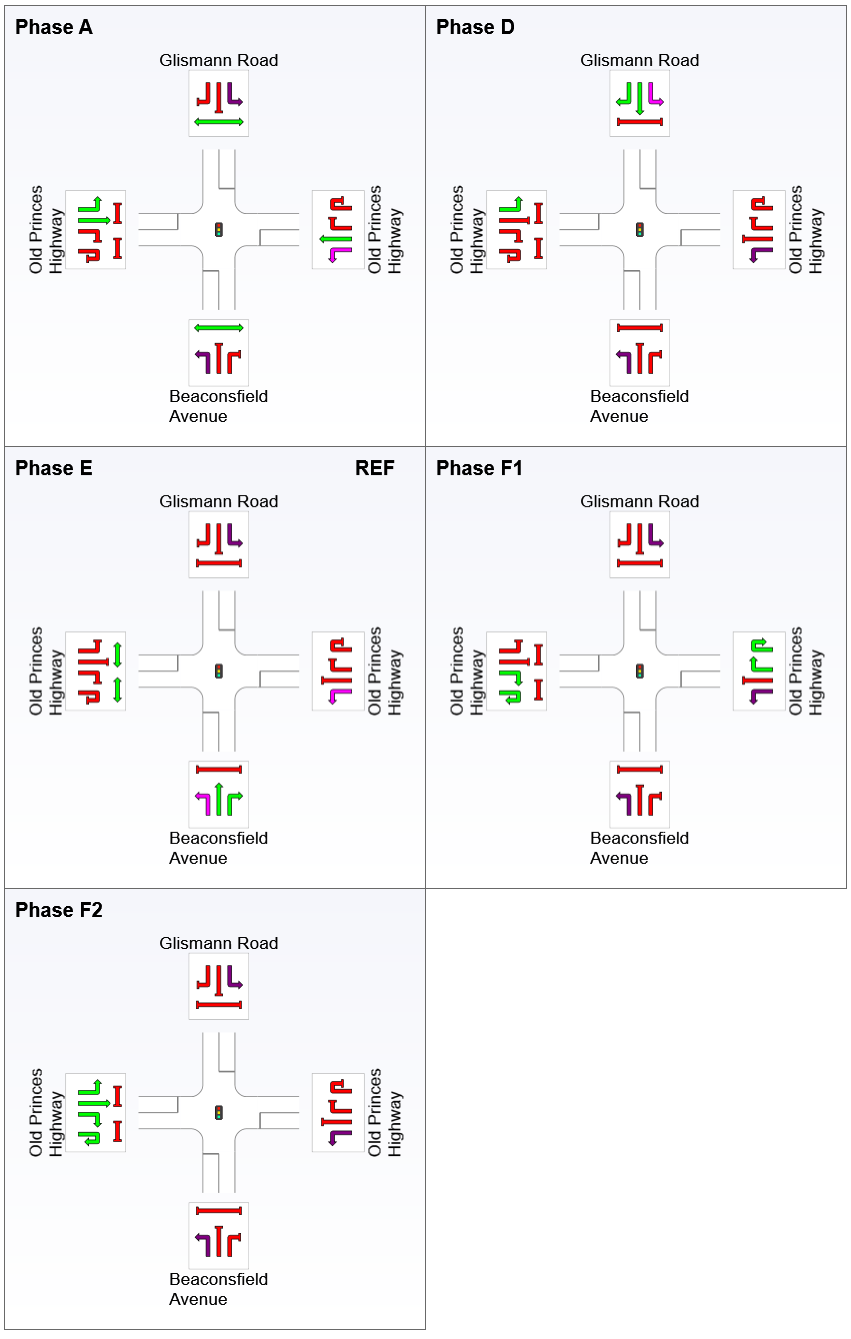
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

[1] Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

Input Phase Sequence

Phase Reference	Sequence: Phase:	Split Phase	Phasing E

Input Phase Sequence: A, D, E, F1, F2



REF: Reference Phase
VAR: Variable Phase

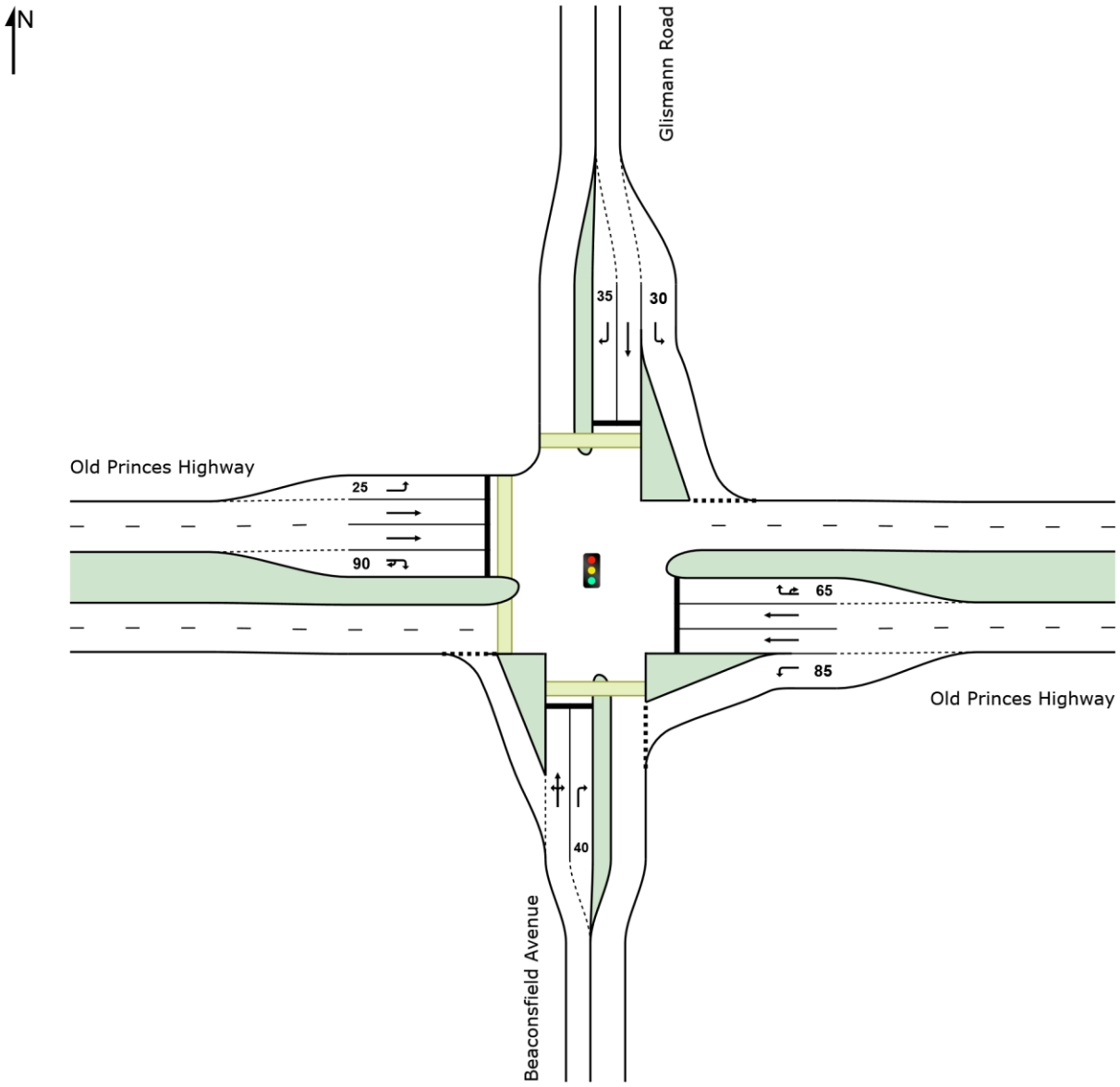
Site: [Old Princes / Beaconsfield / Glismann Int - 8.00 - 9.00 AM Ultimate Proposed (Site Folder: General)]

Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 110 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Green Split Priority has been specified
Phase Sequence: Split Phasing
Reference Phase: Phase E
Input Phase Sequence: A, D, E, F1, F2
Output Phase Sequence: A, D, E, F1, F2

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Beaconsfield Avenue													
Lane 1	150	6.0	295	0.509	100	42.3	LOS D	5.8	42.6	Full	500	0.0	0.0
Lane 2	132	6.0	259	0.509	100	51.3	LOS D	6.7	49.6	Short	40	0.0	NA
Approach	282	6.0		0.509		46.5	LOS D	6.7	49.6				
East: Old Princes Highway													
Lane 1	315	6.0	1549	0.203	100	8.0	LOS A	2.6	19.1	Short	85	0.0	NA
Lane 2	595	9.0	744 [1]	0.800	100	28.3	LOS C	26.8	202.1	Full	500	0.0	0.0
Lane 3	649	9.0	812 [1]	0.800	100	28.8	LOS C	30.1	227.0	Full	500	0.0	0.0
Lane 4	43	2.0	108	0.401	100	63.7	LOS E	2.4	17.0	Short	65	0.0	NA
Approach	1602	8.2		0.800		25.5	LOS C	30.1	227.0				
North: Glismann Road													
Lane 1	109	3.0	721	0.152	100	15.1	LOS B	2.6	18.4	Short	30	0.0	NA
Lane 2	38	3.0	105	0.359	100	59.1	LOS E	2.1	15.1	Full	500	0.0	0.0
Lane 3	42	3.0	100	0.420	100	62.7	LOS E	2.4	16.9	Short	35	0.0	NA
Approach	189	3.0		0.420		34.5	LOS C	2.6	18.4				
West: Old Princes Highway													
Lane 1	11	3.0	1149	0.009	100	14.4	LOS B	0.2	1.5	Short	25	0.0	NA
Lane 2	415	9.0	955 [1]	0.435	100	17.4	LOS B	13.6	102.7	Full	330	0.0	0.0
Lane 3	423	9.0	973	0.435	100	17.5	LOS B	13.9	105.1	Full	330	0.0	0.0
Lane 4	163	4.2	216	0.757	100	61.2	LOS E	9.2	66.4	Short	90	0.0	NA
Approach	1012	8.2		0.757		24.5	LOS C	13.9	105.1				
Intersection	3085	7.7		0.800		27.6	LOS C	30.1	227.0				

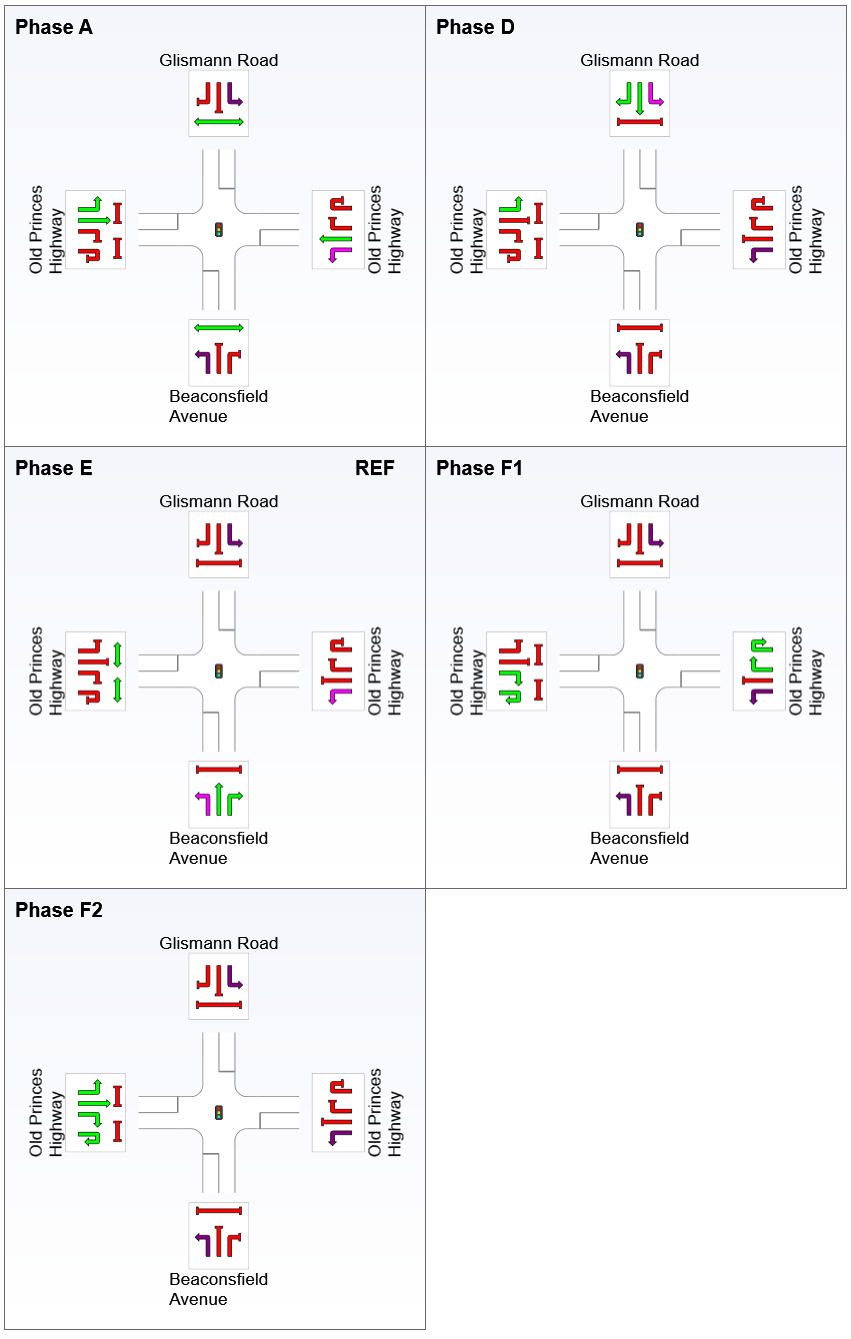
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

[1] Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

Input Phase Sequence

Phase Reference	Sequence: Phase:	Split Phase	Phasing E

Input Phase Sequence: A, D, E, F1, F2



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

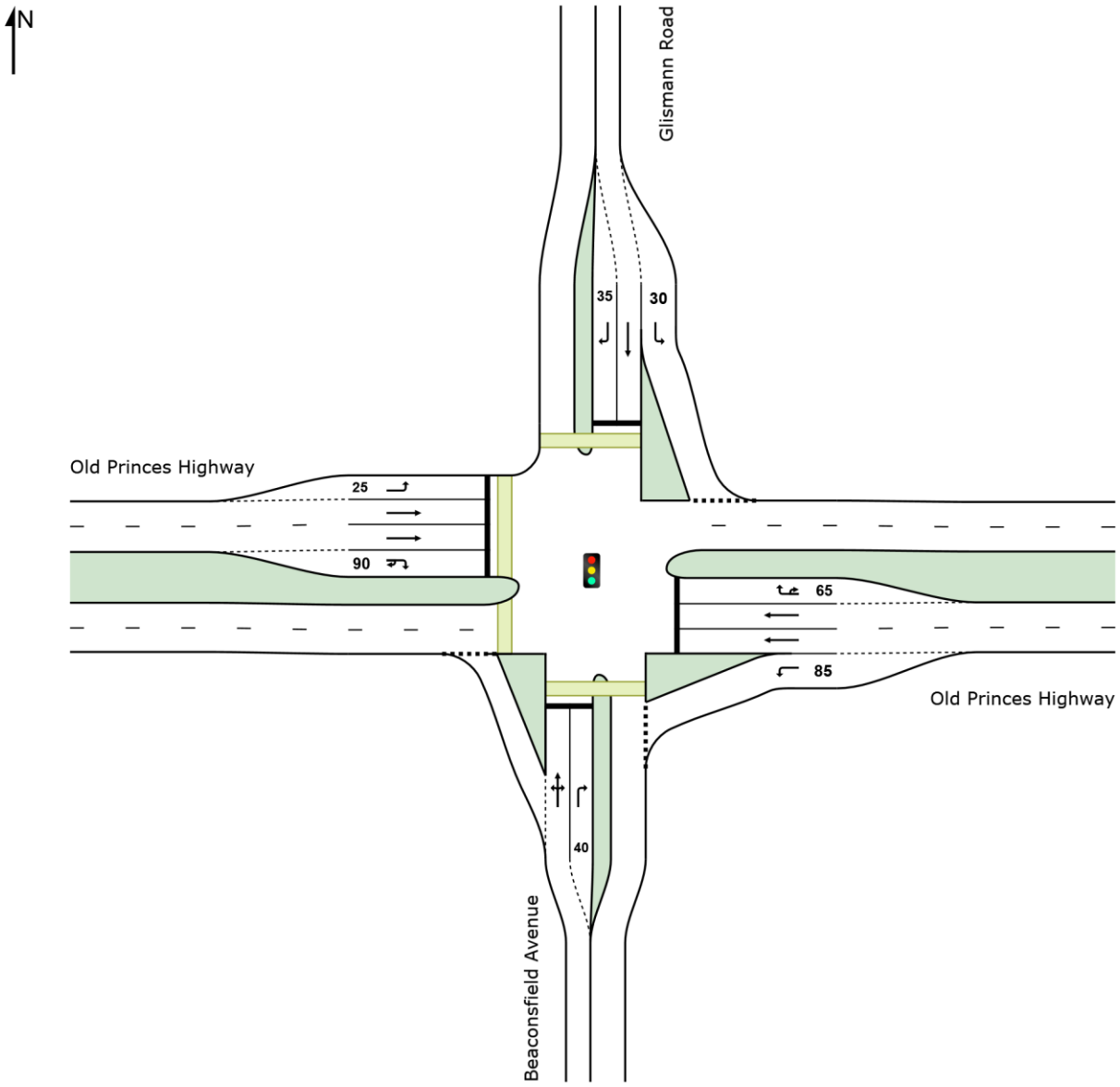
Site: [Old Princes / Beaconsfield / Glismann Int - 3.30 - 4.30 PM Ultimate Proposed (Site Folder: General)]

Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 110 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Green Split Priority has been specified
Phase Sequence: Split Phasing
Reference Phase: Phase E
Input Phase Sequence: A, D, E, F1, F2
Output Phase Sequence: A, D, E, F1, F2

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Beaconsfield Avenue													
Lane 1	211	6.0	287	0.734	100	47.7	LOS D	10.2	75.1	Full	500	0.0	0.0
Lane 2	188	6.0	256 [1]	0.734	100	55.1	LOS E	10.3	75.7	Short	40	0.0	NA
Approach	399	6.0		0.734		51.2	LOS D	10.3	75.7				
East: Old Princes Highway													
Lane 1	192	6.0	1569	0.122	100	7.5	LOS A	1.1	8.4	Short	85	0.0	NA
Lane 2	338	9.0	746	0.453	100	25.9	LOS C	13.2	99.8	Full	500	0.0	0.0
Lane 3	339	9.0	749	0.453	100	25.9	LOS C	13.3	100.1	Full	500	0.0	0.0
Lane 4	59	2.1	93	0.633	100	66.8	LOS E	3.4	24.2	Short	65	0.0	NA
Approach	928	7.9		0.633		24.7	LOS C	13.3	100.1				
North: Glismann Road													
Lane 1	52	3.0	591	0.087	100	14.7	LOS B	1.2	8.4	Short	30	0.0	NA
Lane 2	16	3.0	105	0.150	100	57.9	LOS E	0.9	6.1	Full	500	0.0	0.0
Lane 3	18	3.0	100	0.179	100	61.3	LOS E	1.0	7.0	Short	35	0.0	NA
Approach	85	3.0		0.179		32.5	LOS C	1.2	8.4				
West: Old Princes Highway													
Lane 1	104	3.0	1166	0.089	100	14.5	LOS B	2.1	15.1	Short	25	0.0	NA
Lane 2	680	9.0	877 [1]	0.776	100	20.8	LOS C	27.0	203.5	Full	330	0.0	0.0
Lane 3	685	9.0	883 [1]	0.776	100	20.8	LOS C	27.2	204.9	Full	330	0.0	0.0
Lane 4	132	3.6	301	0.438	100	50.7	LOS D	6.4	46.4	Short	90	0.0	NA
Approach	1601	8.2		0.776		22.8	LOS C	27.2	204.9				
Intersection	3014	7.7		0.776		27.4	LOS C	27.2	204.9				

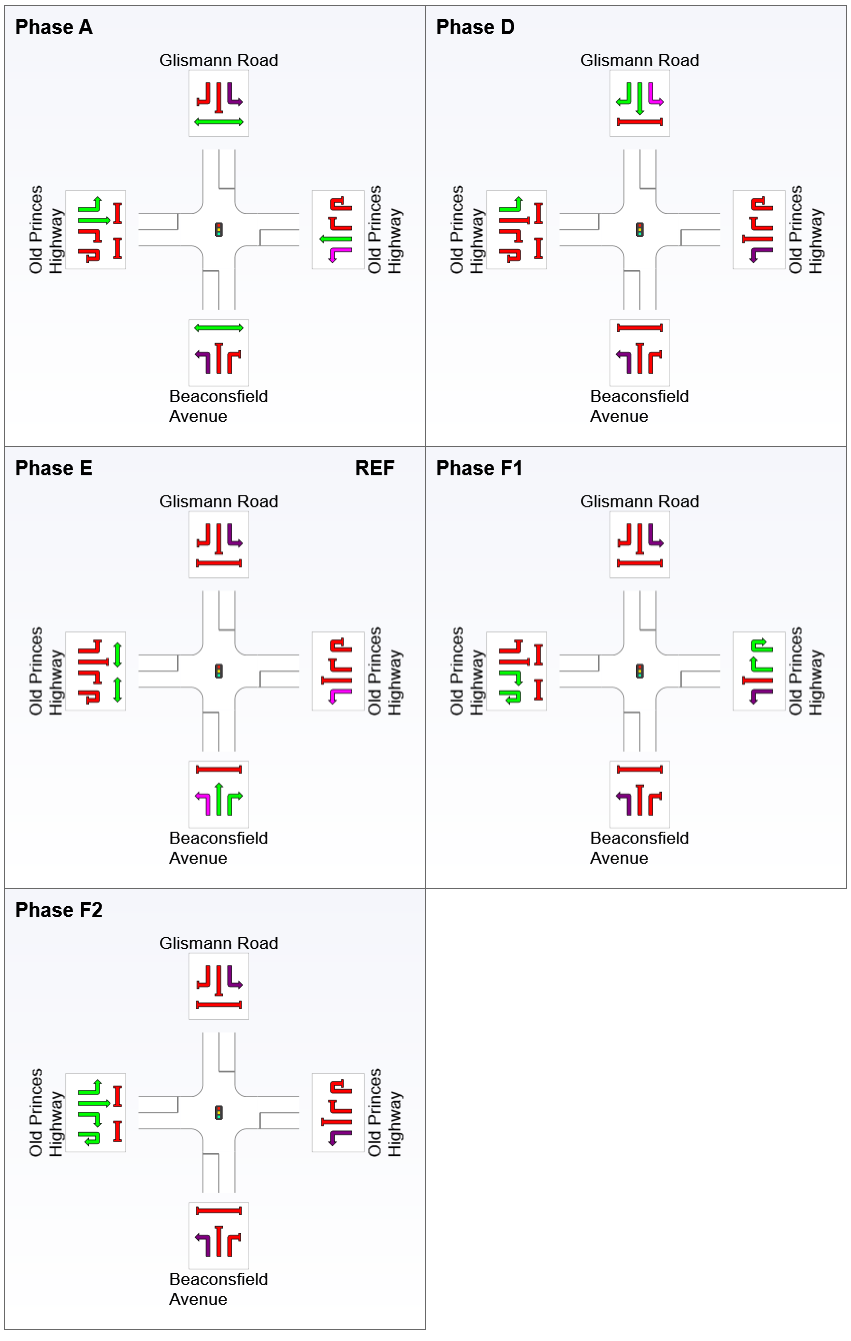
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

[1] Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

Input Phase Sequence

Phase Reference	Sequence: Phase:	Split Phase	Phasing E

Input Phase Sequence: A, D, E, F1, F2



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

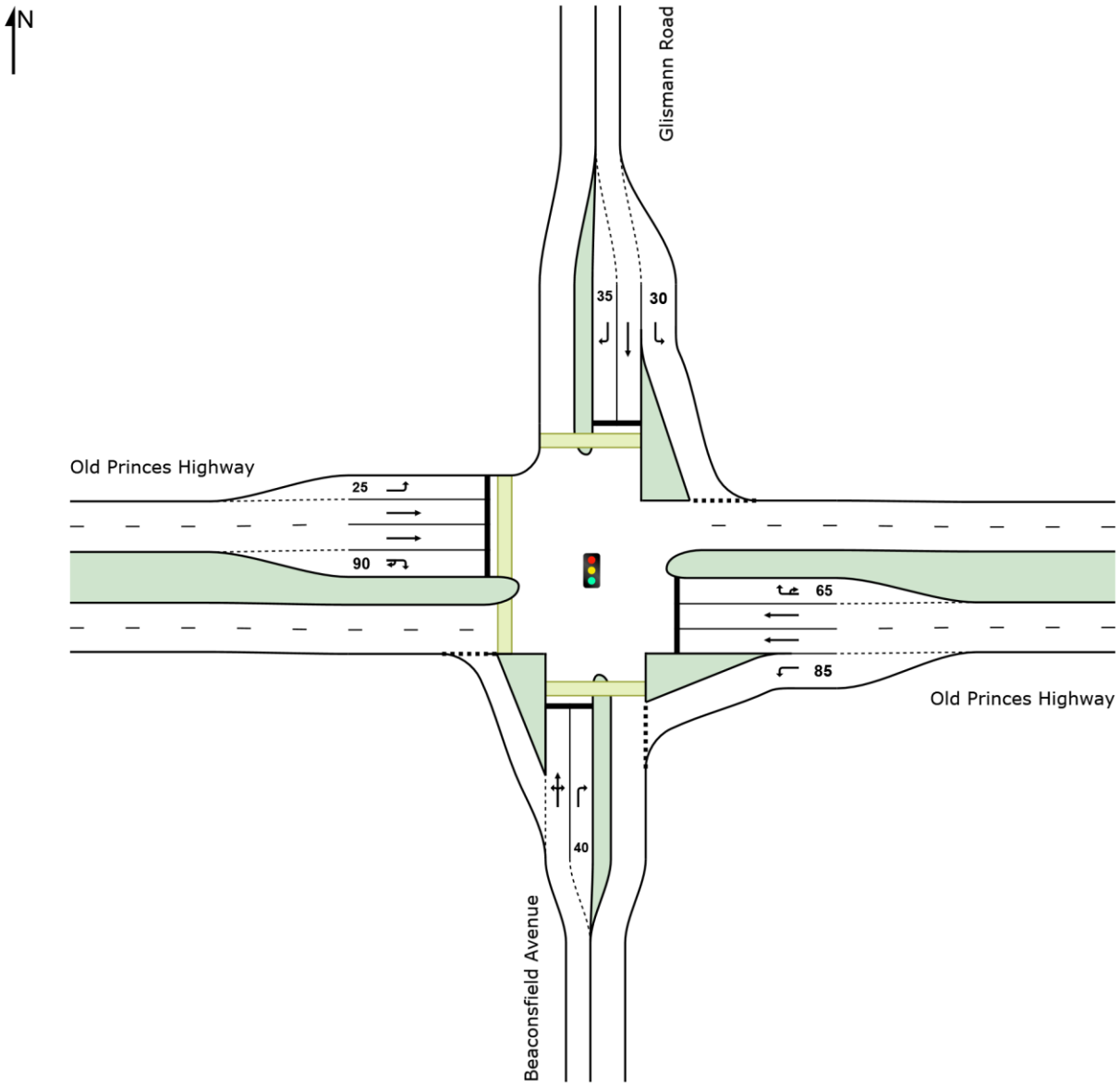
Site: [Old Princes / Beaconsfield / Glismann Int - 4.30 - 5.30 PM Ultimate Proposed (Site Folder: General)]

Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 110 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Green Split Priority has been specified
Phase Sequence: Split Phasing
Reference Phase: Phase E
Input Phase Sequence: A, D, E, F1, F2
Output Phase Sequence: A, D, E, F1, F2

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Beaconsfield Avenue													
Lane 1	141	6.0	275	0.513	100	46.9	LOS D	6.6	48.7	Full	500	0.0	0.0
Lane 2	133	6.0	259	0.513	100	51.3	LOS D	6.8	50.0	Short	40	0.0	NA
Approach	274	6.0		0.513		49.0	LOS D	6.8	50.0				
East: Old Princes Highway													
Lane 1	163	6.0	1646	0.099	100	7.2	LOS A	0.7	5.1	Short	85	0.0	NA
Lane 2	347	9.0	899	0.386	100	19.3	LOS B	11.7	88.5	Full	500	0.0	0.0
Lane 3	348	9.0	902	0.386	100	19.3	LOS B	11.8	88.8	Full	500	0.0	0.0
Lane 4	38	2.8	99	0.384	100	64.7	LOS E	2.1	15.1	Short	65	0.0	NA
Approach	897	8.2		0.386		19.0	LOS B	11.8	88.8				
North: Glismann Road													
Lane 1	42	3.0	604	0.070	100	17.9	LOS B	1.1	7.8	Short	30	0.0	NA
Lane 2	14	3.0	105	0.130	100	57.7	LOS E	0.7	5.3	Full	500	0.0	0.0
Lane 3	22	3.0	100	0.221	100	61.6	LOS E	1.2	8.7	Short	35	0.0	NA
Approach	78	3.0		0.221		37.3	LOS D	1.2	8.7				
West: Old Princes Highway													
Lane 1	99	3.0	1166	0.085	100	14.5	LOS B	2.0	14.3	Short	25	0.0	NA
Lane 2	755	9.0	888 [1]	0.851	100	27.8	LOS C	35.6	268.2	Full	330	0.0	0.0
Lane 3	798	9.0	938 [1]	0.851	100	27.9	LOS C	38.4	289.6	Full	330	0.0	0.0
Lane 4	66	3.4	164	0.405	100	59.1	LOS E	3.5	25.2	Short	90	0.0	NA
Approach	1718	8.4		0.851		28.3	LOS C	38.4	289.6				
Intersection	2966	8.0		0.851		27.6	LOS C	38.4	289.6				

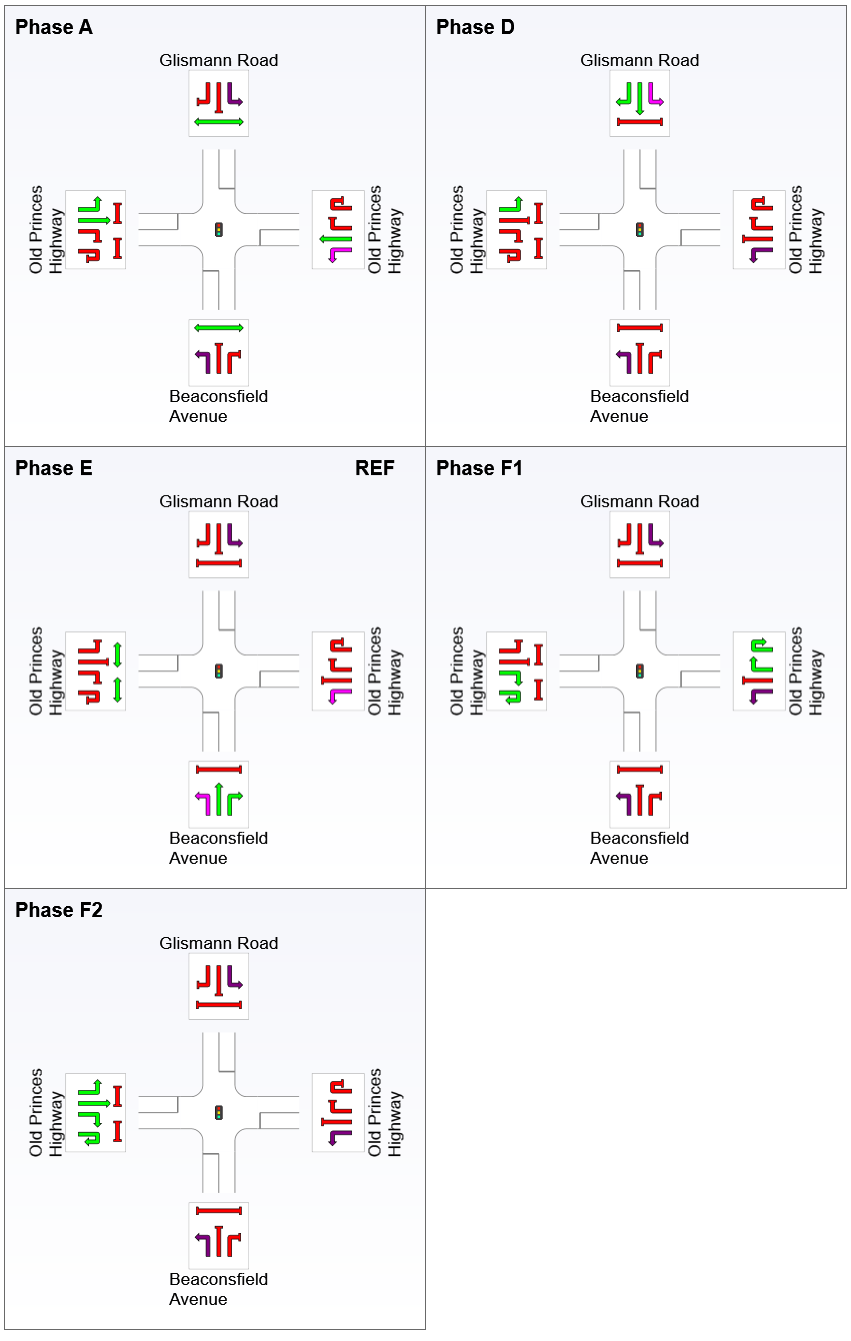
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

[1] Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

Input Phase Sequence

Phase Reference	Sequence: Phase:	Split Phase	Phasing E

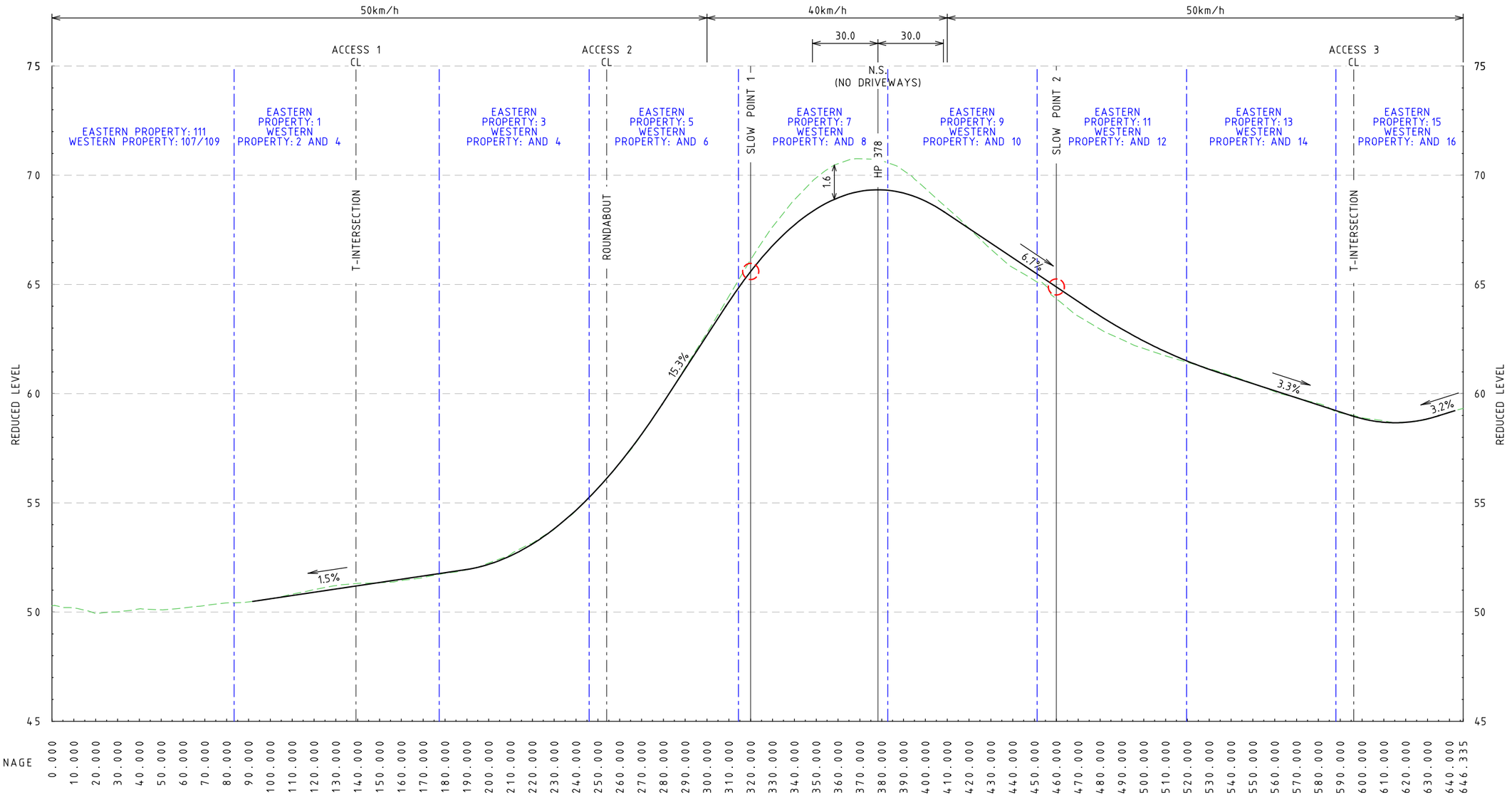
Input Phase Sequence: A, D, E, F1, F2



REF: Reference Phase
VAR: Variable Phase

ATTACHMENT B – MODIFIED SURFACE LEVEL

Longitudinal Section



GLISMANN RD DESIGN LINE
LONGITUDINAL SECTION

MELWAY MAPS 131 K1 & 212 A12

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Sheet 2

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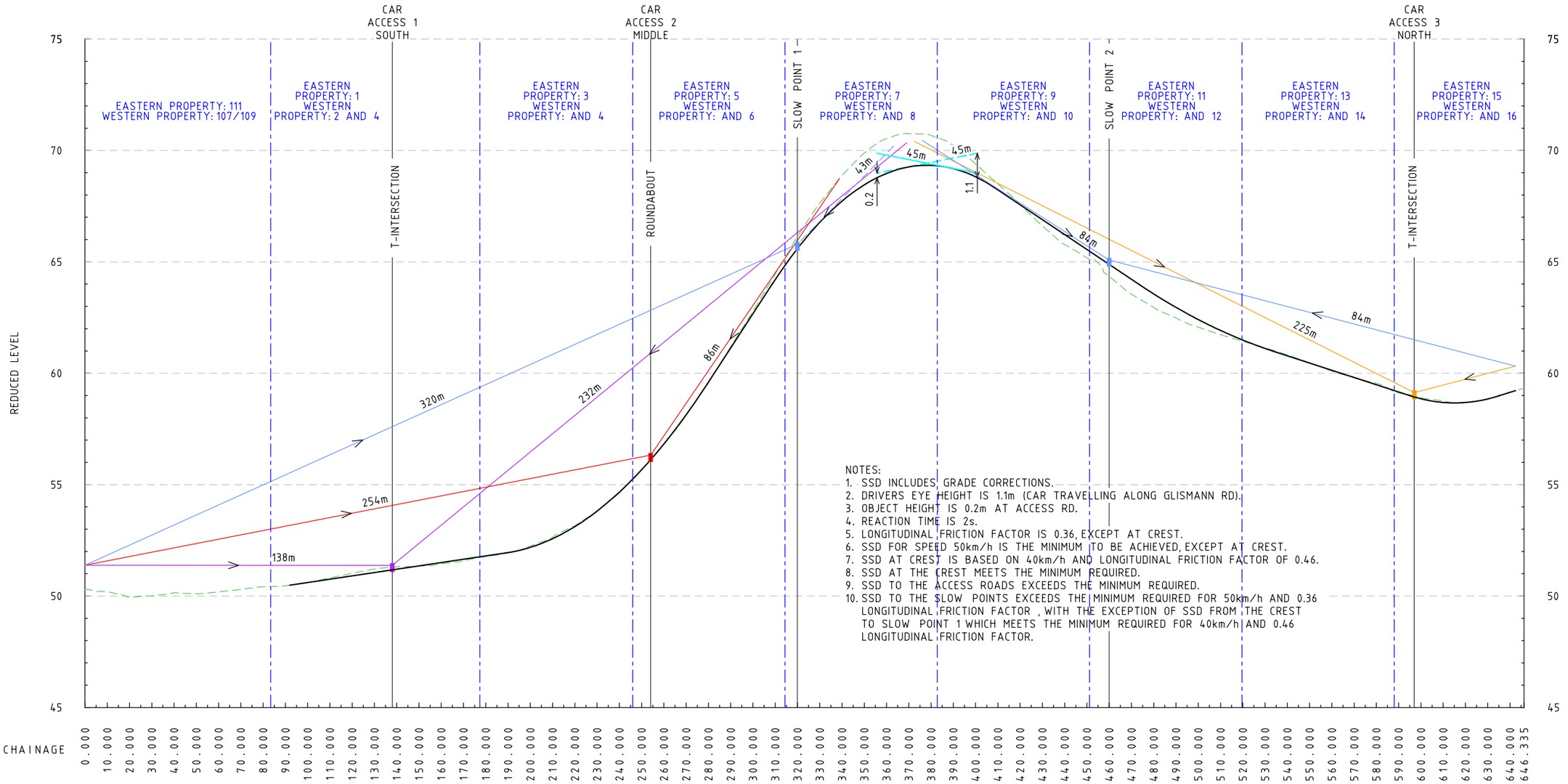
ATTACHMENT C – LONG SECTION - SSD

Stopping Sight Distance (SSD)
Sight Lines along Glismann Rd
Longitudinal Section



NOTES:
1. SSD INCLUDES GRADE CORRECTIONS.
2. DRIVERS EYE HEIGHT IS 1.1m (CAR TRAVELLING ALONG GLISMANN RD).
3. OBJECT HEIGHT IS 0.2m AT ACCESS RD.
4. REACTION TIME IS 2s.
5. LONGITUDINAL FRICTION FACTOR IS 0.36, EXCEPT AT CREST.
6. SSD FOR SPEED 50km/h IS THE MINIMUM TO BE ACHIEVED, EXCEPT AT CREST.
7. SSD AT CREST IS BASED ON 40km/h AND LONGITUDINAL FRICTION FACTOR OF 0.46.
8. SSD AT THE CREST MEETS THE MINIMUM REQUIRED.
9. SSD TO THE ACCESS ROADS EXCEEDS THE MINIMUM REQUIRED.
10. SSD TO THE SLOW POINTS EXCEEDS THE MINIMUM REQUIRED FOR 50km/h AND 0.36 LONGITUDINAL FRICTION FACTOR , WITH THE EXCEPTION OF SSD FROM THE CREST TO SLOW POINT 1 WHICH MEETS THE MINIMUM REQUIRED FOR 40km/h AND 0.46 LONGITUDINAL FRICTION FACTOR.

GLISMANN RD DESIGN LINE
STOPPING SIGHT DISTANCE (SSD)

MELWAY MAPS 131 K1 & 212 A12

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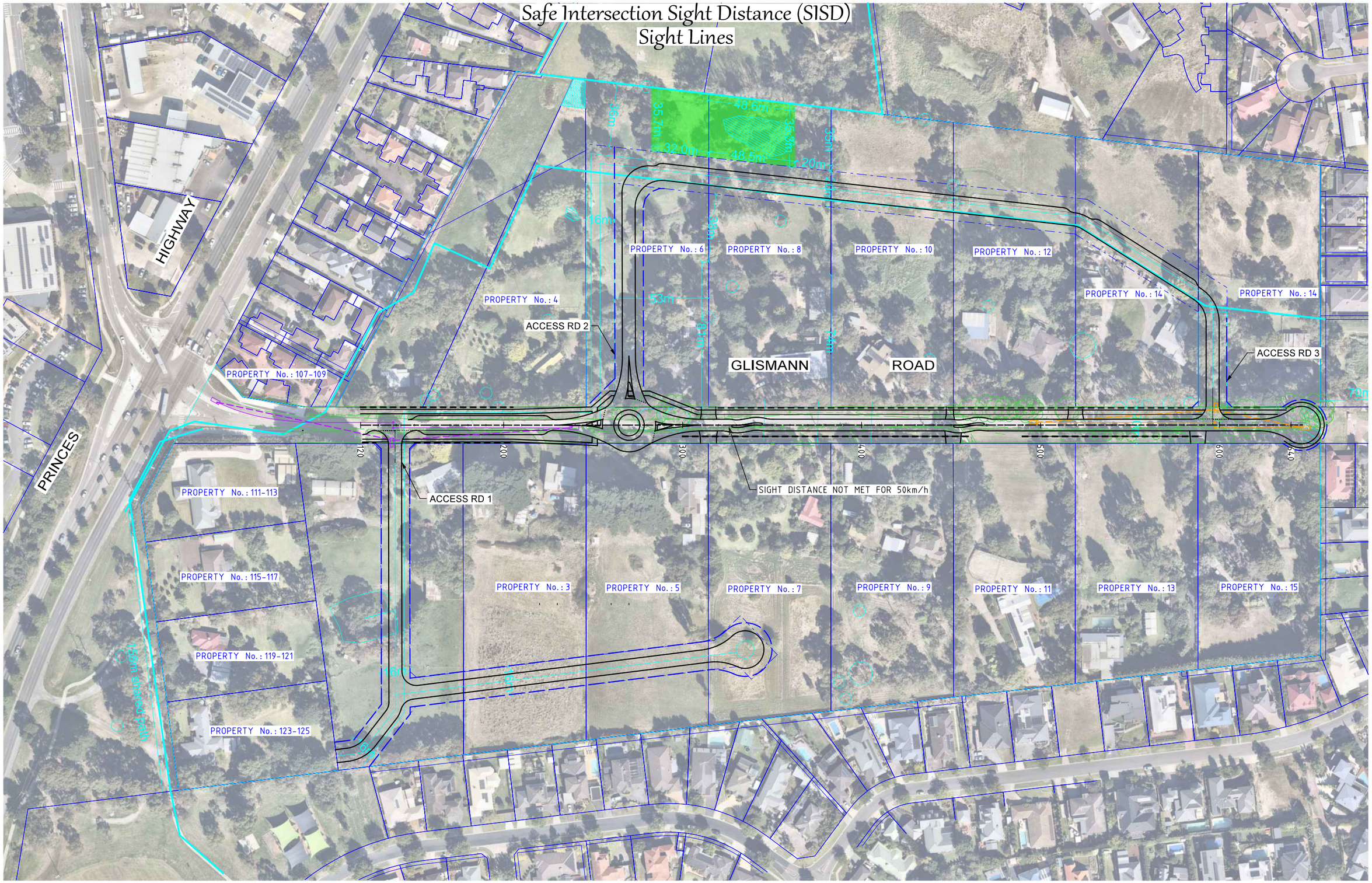
P6

ATTACHMENT D – LONG SECTION - SISD

Safe Intersection Sight Distance (SISD)
Sight Lines



MELWAY MAPS 131 K1 & 212 A12

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Sheet 3

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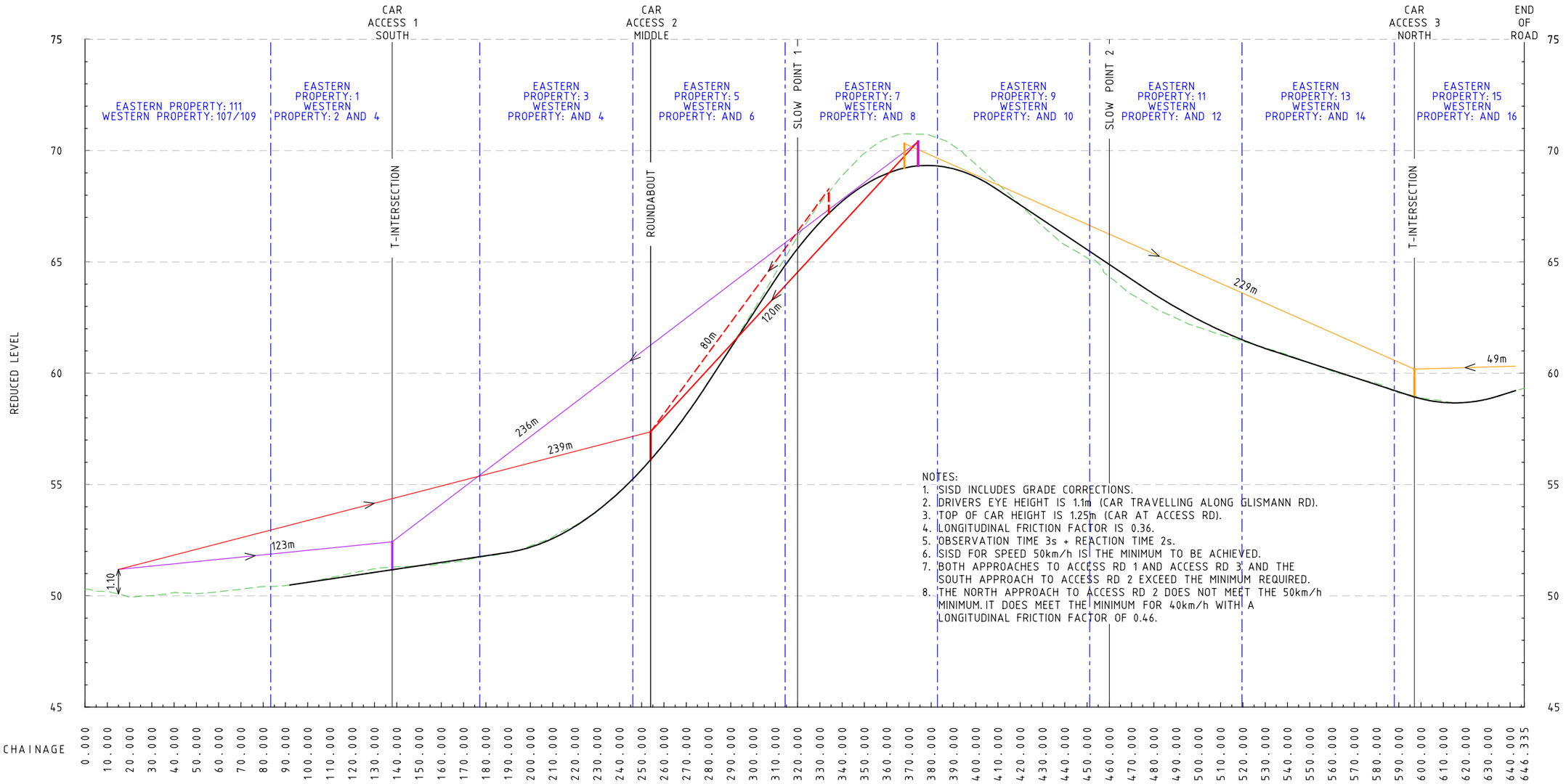
Safe Intersection Sight Distance (SISD)
Sight Lines along Glismann Rd
Longitudinal Section



NOTES:
1. SISD INCLUDES GRADE CORRECTIONS.
2. DRIVERS EYE HEIGHT IS 1.1m (CAR TRAVELLING ALONG GLISMANN RD).
3. TOP OF CAR HEIGHT IS 1.25m (CAR AT ACCESS RD).
4. LONGITUDINAL FRICTION FACTOR IS 0.36.
5. OBSERVATION TIME 3s + REACTION TIME 2s.
6. SISD FOR SPEED 50km/h IS THE MINIMUM TO BE ACHIEVED.
7. BOTH APPROACHES TO ACCESS RD 1 AND ACCESS RD 3 AND THE SOUTH APPROACH TO ACCESS RD 2 EXCEED THE MINIMUM REQUIRED.
8. THE NORTH APPROACH TO ACCESS RD 2 DOES NOT MEET THE 50km/h MINIMUM. IT DOES MEET THE MINIMUM FOR 40km/h WITH A LONGITUDINAL FRICTION FACTOR OF 0.46.

CARS TRAVELLING ALONG GLISMANN RD (DESIGN LINE)
SAFE INTERSECTION SIGHT DISTANCE (SISD)
TO ACCESS ROADS

MELWAY MAPS 131 K1 & 212 A12

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Sheet 4

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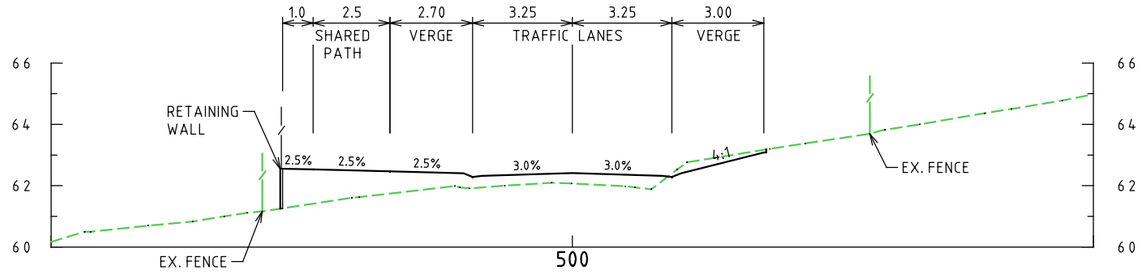
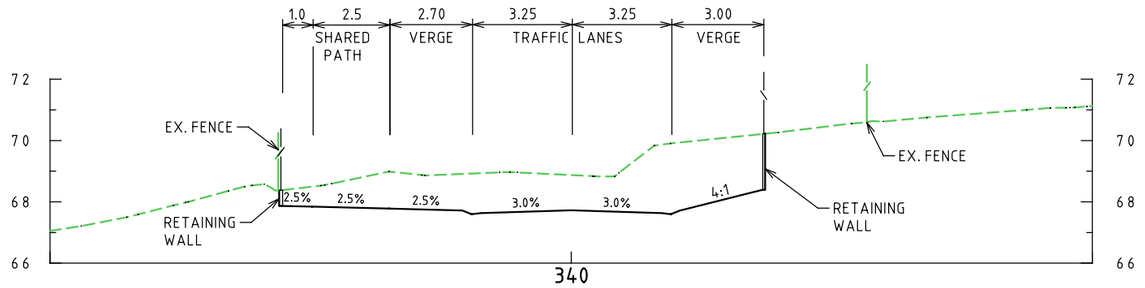
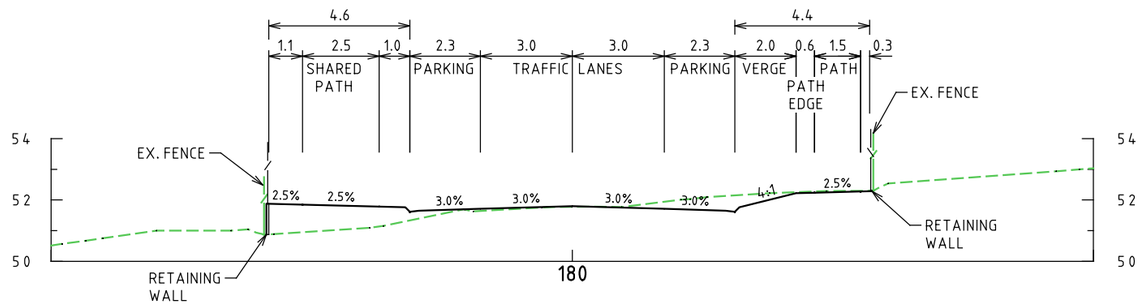
P6

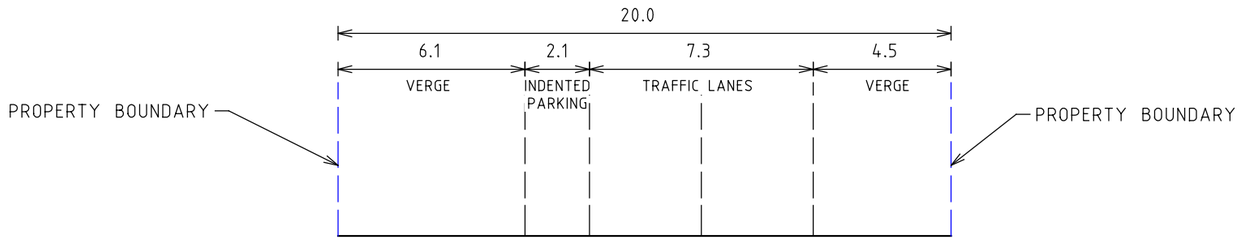
ATTACHMENT E – TYPICAL CROSS SECTIONS

Typical Sections









20m WIDE ROAD RESERVE TYPICAL CROSS SECTION

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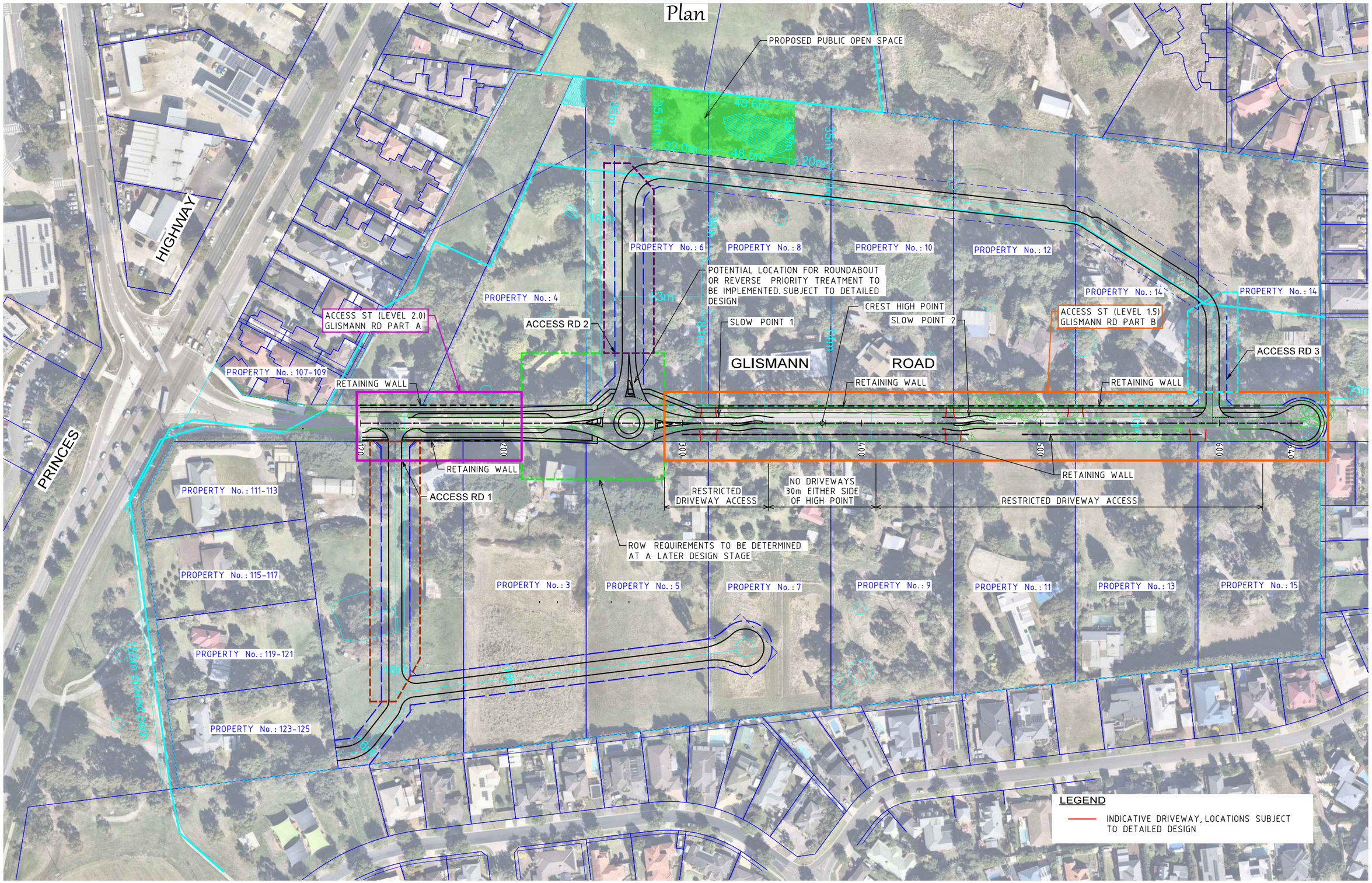
ATTACHMENT F – COST ESTIMATES

Plan



MELWAY MAPS 131 K1 & 212 A12

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Sheet 1

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P6

Project ID: RD-01 of the Glismann Road Development Contribution Plan (Urban Enterprise) June 2020		Glismann Road - Construction of Section 1 - Access Street Level 2				
Item	**Description**	**Quantity**	**Unit**	**Rate $**	**Amount $**	**Comments**
	WORKS					
1	**SITEWORKS AND EARTHWORKS**					
1.1	Preconstruction					
1.2	Pavement Excavation	367	m3	35	12,830	
1.3	Excavation (rock)	132	m3	250	32,949	
1.4	Formation works (fill)	530	m3	35	18,536	
1.5	Set-Out	1	Item	5,000	5,000	
2	**ROAD PAVEMENT**					
2.1	New pavement	937	m2	180	168,660	Incls excavation and sub surface drains
3	**CONCRETE WORKS**					
3.1	Kerb and Channel	220	LM	100	22,000	Incls excavation
3.2	Footpath + Shared Path	400	m2	85	34,000	Incls excavation
3.3	Pram crossings	2	Item	1,500	3,000	Incls excavation
3.4	Retaining wall	80	m2	1,000	80,000	
4	**DRAINAGE**					
4.1	Drainage - pipes	200	LM	350	70,000	
4.2	Drainage - pits/junctions	4	No.	3,500	14,000	Includes connection to existing drain system
4.3	Drainage – Sub-soil drainage	220	LM	55	12,100	Includes flush out pits
4.4	Drainage - WSUD	1	Item	5,000	5,000	Controlling of runoff due to crest
4.5	Drainage - Miscellaneous		Item			
5	**TRAFFIC**					
5.1	Traffic Safety (RSA)	1	Item	2,500	2,500	
6	**LANDSCAPE**					
6.1	Trees	17	No.	250	4,250	1 tree / 12m
6.2	Landscaping	628	m2	15	9,420	Incl top soil/seeding
7	**STREET LIGHTING**					
7.1	Street Lighting	3	Item	12,000	36,000	
8	**MISCELLANEOUS**					
8.1	Linemarking and RRPMs	100	LM	10	1,000	
8.2	Regulatory Signage	2	Item	250	500	
8.3	Fence	100	LM	100	10,000	
9	**SERVICES**					
9.1	Services relocation	1	Item	4,000	4,000	
9.2	Services protection		Item	10,000		
	SUB-TOTAL WORKS				$ 545,745	
10	**DELIVERY**					
10.1	VicRoads	-	%		-	
10.2	Council	3.25	%		$17,157	
10.3	Traffic/Environmental Management	5.5	%		$29,035	
10.4	Survey/Design	5	%		$26,396	
10.5	Supervision & Project Management	9	%		$47,512	
10.6	Site Establishment	2.5	%		$13,198	
10.7	Contingency	30	%		$158,374	
	SUB-TOTAL DELIVERY				$ 291,673	
	TOTAL ESTIMATED COST				$ 837,418	

Project ID: RD-02 of the Glismann Road Development Contribution Plan (Urban Enterprise) June 2020		Glismann Road - Construction of Section 2 - Access Street Level 1.5				
Item	**Description**	**Quantity**	**Unit**	**Rate $**	**Amount $**	**Comments**
	WORKS					
1	**SITEWORKS AND EARTHWORKS**					
1.1	Preconstruction					
1.2	Pavement Excavation	2067	m3	35	72,361	
1.3	Excavation (rock)	947	m3	250	236,794	
1.4	Formation works (fill)	3019	m3	35	105,672	
1.5	Set-Out	1	Item	15,000	15,000	
2	**ROAD PAVEMENT**					
2.1	New pavement	2373	m2	180	427,050	Incls excavation and sub surface drains
3	**CONCRETE WORKS**					
3.1	Kerb and Channel	730	LM	100	73,000	Incls excavation
3.2	Footpath + Shared Path	1460	m2	85	124,100	Incls excavation
3.3	Pram crossings	4	Item	1,500	6,000	Incls excavation
3.4	Retaining wall	405	m2	1,000	405,000	
4	**DRAINAGE**					
4.1	Drainage - pipes	730	LM	350	255,500	
4.2	Drainage - pits/junctions	12	No.	3,500	42,583	Includes connection to existing drain system
4.3	Drainage – Sub-soil drainage	730	LM	55	40,150	Includes flush out pits
4.4	Drainage - WSUD	1	Item	15,208	15,208	Controlling of runoff due to crest
4.5	Drainage - Miscellaneous		Item			
5	**TRAFFIC**					
5.1	Traffic Safety (RSA)	1	Item	2,500	2,500	
5.2	Traffic Calming Devices	2	Item	10,000	20,000	
6	**LANDSCAPE**					
6.1	Trees	61	No.	250	15,250	1 tree / 12m
6.2	Landscaping	3468	m2	15	52,013	Incl top soil/seeding
7	**STREET LIGHTING**					
7.1	Street Lighting	8	Item	12,000	96,000	
8	**MISCELLANEOUS**					
8.1	Linemarking and RRPMs	365	LM	10	3,650	
8.2	Regulatory Signage	7	Item	250	1,825	
8.3	Fence	365	LM	100	36,500	
9	**SERVICES**					
9.1	Services relocation	1	Item	13,000	13,000	
9.2	Services protection		Item	10,000		
	SUB-TOTAL WORKS				$ 2,059,157	
10	**DELIVERY**					
10.1	VicRoads	-	%		-	
10.2	Council	3.25	%		$64,083	
10.3	Traffic/Environmental Management	5.5	%		$108,449	
10.4	Survey/Design	5	%		98,590	
10.5	Supervision & Project Management	9	%		$177,462	
10.6	Site Establishment	2.5	%		$49,295	
10.7	Contingency	30	%		$591,539	
	SUB-TOTAL DELIVERY				$ 1,089,417	
	TOTAL ESTIMATED COST				$ 3,148,574	
	RD-02 Items associated with design, siteworks, earthworks and retaining wall components (including 30% contingency)				$ 1,213,442	

Project ID: RD-03 of the Glismann Road Development Contribution Plan (Urban Enterprise) June 2020		Construction of Local Access Street Level 1 (west of Glismann Road, southern section)				
Item	**Description**	**Quantity**	**Unit**	**Rate $**	**Amount $**	**Comments**
	WORKS					
1	**SITEWORKS AND EARTHWORKS**					
1.1	Preconstruction					
1.2	Pavement Excavation	166	m3	35	5,813	
1.3	Excavation (rock)		m3	250		
1.4	Formation works (fill)		m3	35		
1.5	Set-Out	1	Item	4,167	4,167	
2	**ROAD PAVEMENT**					
2.1	New pavement	730	m2	180	131,400	Incls excavation and sub surface drains
3	**CONCRETE WORKS**					
3.1	Kerb and Channel	200	LM	100	20,000	Incls excavation
3.2	Footpath + Shared Path	300	m2	85	25,500	Incls excavation
3.3	Pram crossings	2	Item	1,500	3,000	Incls excavation
4	**DRAINAGE**					
4.1	Drainage - pipes	200	LM	350	70,000	
4.2	Drainage - pits/junctions	3	No.	3,500	11,667	Includes connection to existing drain system
4.3	Drainage – Sub-soil drainage	200	LM	55	11,000	Includes flush out pits
4.4	Drainage - WSUD		Item			
4.5	Drainage - Miscellaneous		Item			
5	**TRAFFIC**					
5.1	Traffic Safety (RSA)	1	Item	2,500	2,500	
6	**LANDSCAPE**					
6.1	Trees	17	No.	250	4,250	1 tree / 12m
6.2	Landscaping	570	m2	15	8,550	Incl top soil/seeding
7	**STREET LIGHTING**					
7.1	Street Lighting	2	Item	12,000	24,000	
8	**MISCELLANEOUS**					
8.1	Linemarking and RRPMs		LM	10		
8.2	Regulatory Signage	2	Item	250	500	
9	**SERVICES**					
9.1	Services relocation		Item	5,000	0	
9.2	Services protection		Item	10,000		
	SUB-TOTAL WORKS				$ 322,346	
10	**DELIVERY**					
10.1	VicRoads	-	%		-	
10.2	Council	3.25	%		$10,152	
10.3	Traffic/Environmental Management	5.5	%		$17,180	
10.4	Survey/Design	5	%		$15,618	
10.5	Supervision & Project Management	9	%		$28,113	
10.6	Site Establishment	2.5	%		$7,809	
10.7	Contingency	30	%		$93,710	
	SUB-TOTAL DELIVERY				$ 172,583	
	TOTAL ESTIMATED COST				$ 494,929	

Project ID: RD-04 of the Glismann Road Development Contribution Plan (Urban Enterprise) June 2020		Construction of Local Access Street Level 1 (west of Glismann Road, northern section)				
Item	**Description**	**Quantity**	**Unit**	**Rate $**	**Amount $**	**Comments**
	WORKS					
1	**SITEWORKS AND EARTHWORKS**					
1.1	Preconstruction					
1.2	Pavement Excavation	108	m3	35	3,778	
1.3	Excavation (rock)		m3	250		
1.4	Formation works (fill)		m3	35		
1.5	Set-Out	1	Item	3,000	3,000	
2	**ROAD PAVEMENT**					
2.1	New pavement	475	m2	180	85,410	Incls excavation and sub surface drains
3	**CONCRETE WORKS**					
3.1	Kerb and Channel	130	LM	100	13,000	Incls excavation
3.2	Footpath + Shared Path	195	m2	85	16,575	Incls excavation
3.3	Pram crossings	2	Item	1,500	3,000	Incls excavation
4	**DRAINAGE**					
4.1	Drainage - pipes	130	LM	350	45,500	
4.2	Drainage - pits/junctions	2	No.	3,500	7,000	Includes connection to existing drain system
4.3	Drainage – Sub-soil drainage	130	LM	55	7,150	Includes flush out pits
4.4	Drainage - WSUD		Item			
4.5	Drainage - Miscellaneous		Item			
5	**TRAFFIC**					
5.1	Traffic Safety (RSA)	1	Item	2,500	2,500	
6	**LANDSCAPE**					
6.1	Trees	11	No.	250	2,750	1 tree / 12m
6.2	Landscaping	371	m2	15	5,558	Incl top soil/seeding
7	**STREET LIGHTING**					
7.1	Street Lighting	1	Item	12,000	12,000	
8	**MISCELLANEOUS**					
8.1	Linemarking and RRPMs		LM	10		
8.2	Regulatory Signage	2	Item	250	500	
9	**SERVICES**					
9.1	Services relocation		Item	5,000	0	
9.2	Services protection		Item	10,000		
	SUB-TOTAL WORKS				$ 207,721	
10	**DELIVERY**					
10.1	VicRoads	-	%		-	
10.2	Council	3.25	%		$6,531	
10.3	Traffic/Environmental Management	5.5	%		$11,052	
10.4	Survey/Design	5	%		$10,047	
10.5	Supervision & Project Management	9	%		$18,085	
10.6	Site Establishment	2.5	%		$5,024	
10.7	Contingency	30	%		$60,283	
	SUB-TOTAL DELIVERY				$ 111,021	
	TOTAL ESTIMATED COST				$ 318,741	

Project ID: RD-05 of the Glismann Road Development Contribution Plan (Urban Enterprise) June 2020		Construction of Local Access Street Level 1 (east of Glismann Road)				
Item	**Description**	**Quantity**	**Unit**	**Rate $**	**Amount $**	**Comments**
	WORKS					
1	**SITEWORKS AND EARTHWORKS**					
1.1	Preconstruction					
1.2	Pavement Excavation	249	m3	35	8,719	
1.3	Excavation (rock)		m3	250		
1.4	Formation works (fill)		m3	35		
1.5	Set-Out	1	Item	6,250	6,250	
2	**ROAD PAVEMENT**					
2.1	New pavement	1095	m2	180	197,100	Incls excavation and sub surface drains
3	**CONCRETE WORKS**					
3.1	Kerb and Channel	300	LM	100	30,000	Incls excavation
3.2	Footpath + Shared Path	450	m2	85	38,250	Incls excavation
3.3	Pram crossings	2	Item	1,500	3,000	Incls excavation
4	**DRAINAGE**					
4.1	Drainage - pipes	300	LM	350	105,000	
4.2	Drainage - pits/junctions	5	No.	3,500	17,500	Includes connection to existing drain system
4.3	Drainage - Sub-soil drainage	300	LM	55	16,500	Includes flush out pits
4.4	Drainage - WSUD		Item			
4.5	Drainage - Miscellaneous		Item			
5	**TRAFFIC**					
5.1	Traffic Safety (RSA)	1	Item	2,500	2,500	
6	**LANDSCAPE**					
6.1	Trees	25	No.	250	6,250	1 tree / 12m
6.2	Landscaping	855	m2	15	12,825	Incl top soil/seeding
7	**STREET LIGHTING**					
7.1	Street Lighting	2	Item	12,000	24,000	
8	**MISCELLANEOUS**					
8.1	Linemarking and RRPMs		LM	10		
8.2	Regulatory Signage	2	Item	250	500	
9	**SERVICES**					
9.1	Services relocation		Item	5,000	0	
9.2	Services protection		Item	10,000		
	SUB-TOTAL WORKS				$ 468,394	
10	**DELIVERY**					
10.1	VicRoads	-	%		-	
10.2	Council	3.25	%		$14,736	
10.3	Traffic/Environmental Management	5.5	%		$24,938	
10.4	Survey/Design	5	%		$22,671	
10.5	Supervision & Project Management	9	%		$40,808	
10.6	Site Establishment	2.5	%		$11,336	
10.7	Contingency	30	%		$136,028	
	SUB-TOTAL DELIVERY				$ 250,517	
	TOTAL ESTIMATED COST				$ 718,911	

Project ID: TM-01 of the Glismann Road Development Contribution Plan (Urban Enterprise) June 2020		Glismann Road - Roundabout Construction				
Item	**Description**	**Quantity**	**Unit**	**Rate $**	**Amount $**	**Comments**
	WORKS					
1	**SITEWORKS AND EARTHWORKS**					
1.1	Preconstruction					
1.2	Pavement Excavation	282	m3	35	9,874	
1.3	Excavation (rock)		m3	250		
1.4	Formation works (fill)		m3	35		
1.5	Set-Out	1	Item	3,000	3,000	
2	**ROAD PAVEMENT**					
2.1	New pavement	1240	m2	180	223,200	Incls excavation and sub surface drains
3	**CONCRETE WORKS**					
3.1	Kerb and Channel	200	LM	100	20,000	Incls excavation
3.2	Footpath + Shared Path	250	m2	85	21,250	Incls excavation
3.3	Pram crossings	4	Item	1,500	6,000	Incls excavation
3.4	Concrete Islands	280	m2	100	28,000	Incls excavation
4	**DRAINAGE**					
4.1	Drainage - pipes	160	LM	350	56,000	
4.2	Drainage - pits/junctions	6	No.	3,500	21,000	Includes connection to existing drain system
4.3	Drainage - Sub-soil drainage	160	LM	55	8,800	Includes flush out pits
5	**TRAFFIC**					
5.1	Traffic Safety (RSA)	1	Item	2,500	2,500	
6	**LANDSCAPE**					
6.1	Landscaping	40	m2	75	3,000	plants, topsoiling and grass
7	**STREET LIGHTING**					
7.1	Street Lighting	2	Item	12,000	24,000	
8	**MISCELLANEOUS**					
8.1	Linemarking and RRPMs	20	LM	10	200	
8.2	Regulatory Signage	9	Item	250	2,250	
9	**SERVICES**					
9.1	Services relocation	1	Item	3,000	3,000	
9.2	Services protection		Item	10,000		
	SUB-TOTAL WORKS				$ 438,914	
10	**DELIVERY**					
10.1	VicRoads	-	%		-	
10.2	Council	3.25	%		$14,265	
10.3	Traffic/Environmental Management	5.5	%		$24,140	
10.4	Survey/Design	5	%		$21,946	
10.5	Supervision & Project Management	9	%		$39,502	
10.6	Site Establishment	2.5	%		$10,973	
10.7	Contingency	30	%		$131,674	
	SUB-TOTAL DELIVERY				$ 242,500	
	TOTAL ESTIMATED COST				$ 681,413	

1st Floor 132 Upper Heidelberg Rd Ivanhoe Vic 3079
PO Box 417 Ivanhoe Vic 3079
ABN: 59 125 488 977
Ph: (03) 9490 5900 Fax: (03) 9490 5910
www.trafficworks.com.au